PB89-206205

Superfund Record of Decision (EPA Region 3) Delaware Sand and Gravel Site, New Castle, Delaware (First Remedial Action) April 1988

(U.S.) Environmental Protection Agency, Washington, DC

22 Apr 88

U.S. Department of Commerce
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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Delaware Sand & Gravel (DS&G) site is a 27-acre inactive industrial waste landfill located in New Castle County, Delaware. It is bordered by Army Creek to the west, Army Creek and wetlands to the north, residential and business facilities to the east, and an abandoned sand and gravel quarry to the south. Also to the west of the site directly across Army Creek is the Army Creek Landfill NPL site. Residences are located approximately 30 feet from the landfill and a residential development is located approximately 0.5 miles south and southwest of the site. Underlying the landfill is the Potomac Aquifer, which is accessed about 1.25 miles south of the site and used as a public water source. The DS&G site consists of four disposal areas, referred to as the Drum Disposal, Inert Disposal, Ridge, and Grantham South areas. Between 1968 and 1976 the site accepted household and construction wastes and approximately 7,000 drums containing liquids and sludges from perfume, plastics, paint, and petroleum refining processes. In 1971, investigations revealed ground water contamination emanating from the Army Creek and DS&G landfills. In 1976, the Delaware Department of Natural Resources and Environmental Control issued an enforcement action requiring

(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision - Delaware Sand & Gravel, De
First Remedial Action
Contaminated Media: gw, soil
Key Contaminants: VOCs (benzene, toluene, xylenes), Organics (PCBs, PAH, Phenols), metals (Chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 84
	20. Security Class (This Page) None	22. Price

EPA/ROD/R03-88/048
Delaware Sand & Gravel, DE
First Remedial Action

16. ABSTRACT (continued)

DS&G to discontinue disposal activities. A ground water recovery system was installed to prevent contaminated water from reaching the nearby private wellfield, which continues to operate. Investigations were conducted to characterize the source and extent of contamination from both sites, and in 1984 EPA initiated an emergency removal action at the DS&G site to remove approximately 600 drums from the Drum Disposal area. An estimated 535,000 yd3 of waste material are located onsite. Wastes identified in the Drum Disposal area include subsurface soil and debris contaminated with PCBs, organic liquids, and inorganic solids. The Drum Disposal area is believed to be the major source of organic ground water contamination. The Ridge area consists of contaminated surficial soil, and drums, storage tanks and debris scattered on the surface. The Inert Disposal area contains various domestic waste, cars, trucks and storage tanks scattered on the surface. The Grantham South area is believed to contain surficial inert waste as well as deposited chemical wastes. Two hot spots of organic contamination were identified in this area. The primary contaminants of concern affecting the soil and ground water are VOCs including benzene, toluene, and xylenes, other organics including PCBs, PAHs, and phenols, and metals including chromium and lead.

The selected remedial action for this site includes: excavation and onsite mobile incineration of approximately 36,000 tons of contaminated soil and wastes from the Drum Disposal and Ridge areas, with on- or offsite disposal of residual ash and grading and revegetation of excavated areas; removal and offsite disposal of all surface debris material from the Inert area, followed by capping; construction of a RCRA cap over the Grantham South area; ground water pump and treatment with discharge to Army Creek; and ground water monitoring. The estimated present worth cost for this remedial action is $24,944,000.

PERFORMANCE STANDARDS OR GOALS: The ground water remedy will result in MCLs or 10-6 risk levels being met at the site boundary. Ground water treatment will attain the levels specified in the NPDES regulations before being discharged to Army Creek. Individual goals were not specified. Excavation in the Drum Disposal area will attain soil contaminant levels based on acceptable drinking water exposure, including toluene 6,000 mg/kg, xylene 4.8 mg/kg, and phenol 497 mg/kg.

INSTITUTIONAL CONTROLS: Not applicable.

KEYWORDS: Acids; ARARs; Benzene; Capping; Carcinogenic Compounds; Chromium; Clean Water Act; Containment; Debris, Direct Contact; Drinking Water Contaminants; Drinking Water Standards; Excavation; Ground Water; Ground Water Monitoring; Ground Water Treatment; Incineration; Inorganics; Landfill Closure; Lead; MCLs; Metals; Offsite Disposal; O&M; Onsite Containment; Onsite Discharge; Onsite Treatment; PAHs; PCBs; Phenols; Plume Management; Public Exposure; RCRA; RCRA Closure Requirements; Safe Drinking Water Act; Soil; State Criteria; State Permit; Toluene; Treatment Technology; VOCs; Water Quality Criteria; Xylenes.

ATTENTION

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EPA/ROD/R03-88/048
April 1988

PB89-206205

EPA

Superfund Record of Decision:

Delaware Sand & Gravel, DE

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U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

Record of Decision

Declaration

Site Name, Location and Description

Delaware Sand and Gravel Site
Grantham Lane
New Castle, DE

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Delaware Sand and Gravel Site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the greatest extent practicable is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of 1985 (40 C.F.R. Part 300).

This decision is based upon the contents of the Administrative Record for the Delaware Sand and Gravel Site.

The State of Delaware developed this decision document in conjunction with EPA and therefore concurs with the selected remedy.

Description of the Remedy

The Remedy selected addresses the sources of contamination by remediation of on-site wastes and contaminated soils as well as addressing remediation of the groundwater contamination plume.

The major components of the selected remedy include:

- Excavate wastes and contaminated soil from the Drum Disposal and Ridge Area and treat the wastes and contaminated soil by on-site incineration to alleviate the direct contact threat and leachate generation from the major contamination sources on the site.

- Capping of the Grantham South Area in order to alleviate direct contact threat and potential leachate generation.

- Debris Removal and Capping the Inert Disposal Area to alleviate potential direct contact threat and to meet State of Delaware Solid Waste Regulations.

- Continue recovery of contaminated groundwater to eliminate potential groundwater ingestion risk.

- Implementation of treatment of recovered contaminated groundwater prior to discharge to Army Creek.

Declaration

The selected remedy is protective of human health and environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility or volume as a principal element. Finally, it is determined that this remedy utilized permanent solutions and alternative treatment technology to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on-site, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Phillip G. Retallick
Director of the Division of Air and
Waste Management
Dept. of Natural Resources and
Environmental Control
State of Delaware

April 21, 1988
Date

James M. Seif
Regional Administrator
EPA Region III

4/22/88
Date

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF AIR & WASTE MANAGEMENT
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APR 2 1 1990

Mr. James M. Seif
Regional Administrator
U.S. EPA Region III
841 Chestnut Street
Philadelphia, PA 19114

Subject: Declaration of the ROD - Delaware Sand & Gravel

Dear Mr Seif Jim

As per Cooperative Agreement #V-003299-01-7, the Delaware Department of Natural Resources and Environmental Control (DNREC), CERCLA Management Branch has completed the Record of Decision for the Delaware Sand & Gravel site.

Through the coordinated efforts of DNREC and EPA, the Department feels an appropriate remedy for the site has been selected. By signature of the Declaration of the ROD, DNREC has formally expressed its support of the selected remedy.

In order to finalize the Delaware Sand & Gravel ROD, we are now requesting EPA's signature on the Declaration of the ROD.

Sincerely,

Phillip G. Retallick
Director

PGR:NC/mff
NC2100.2

cc: G. A. Molchan
J. J. Hardman
N. V. Raman

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Delaware Sand & Gravel

Record of Decision

Decision Summary

I. SITE NAME, LOCATION AND DESCRIPTION

The Delaware Sand and Gravel Landfill (DS&G) is an inactive industrial waste landfill located in New Castle County, Delaware. The site is approximately two miles southwest of the City of New Castle on Grantham Lane, west of Route 9, and less than one mile east of the intersections of Routes 13 and 40 as shown in Figure 1.1

The property considered as the Delaware Sand and Gravel Landfill is approximately 27 acres in size. Wastes are located in four smaller areas on the property. The smaller areas are referred to as the Drum Disposal, Inert Disposal, Ridge, and Grantham South areas (Figure 1.2) Wastes disposed on site include household and construction waste and approximately 7,000 drums containing industrial liquids and sludges.

The area surrounding the site includes Army Creek (a tributary to the Delaware River) to the west, Army Creek and wetland area to the north, residential and business facilities to the east, and an abandoned sand and gravel quarry to the south. Also to the west of the site, directly across Army Creek, is the Army Creek Landfill, an inactive municipal landfill currently on the National Priorities List.

The site is not located in Army Creek's floodplain. Also it has been determined no wetlands of significance exist on the site. Wetlands do exist in peripheral areas but will not be impacted by remedial action on-site.

The closest residences to the site are located approximately 30 ft. from the landfill on Grantham Lane. Also Llangollen Estates, a residential development is located approximately 1/2 mile south and southwest of the site.

Underlying the site are two water bearing formations. The uppermost is the Columbia water table aquifer which is practically nonexistent at the site. Under the landfill the aquifer of concern is the Potomac Aquifer located approximately 30 ft. below land surface.

Prior to 1952, groundwater flow in the Potomac aquifer was predominantly to the west. Since 1952, groundwater has moved within the Potomac Aquifer to the southeast, east, south, and southwest due to various water supply and recovery well pumpage scenerios.

At present the flow is predominantly in the westerly direction toward the recovery wells.

The Potomac aquifer is used approximately 1 1/4 miles south of the site as a public water source by Artesian Water Company.

II. SITE HISTORY

The Delaware Sand and Gravel Landfill was formerly operated as a sand and gravel quarry. Waste disposal began on a permitted basis in 1968 and continued until 1976 when the DNREC issued enforcement action for improper disposal operation.

Investigations in the area began as early as 1971, when a residential well southwest of the Army Creek Landfill developed water quality problems. Early investigations revealed that leachate most likely originating from the Army Creek Landfill and Delaware Sand and Gravel Landfill was contaminating local aquifers.

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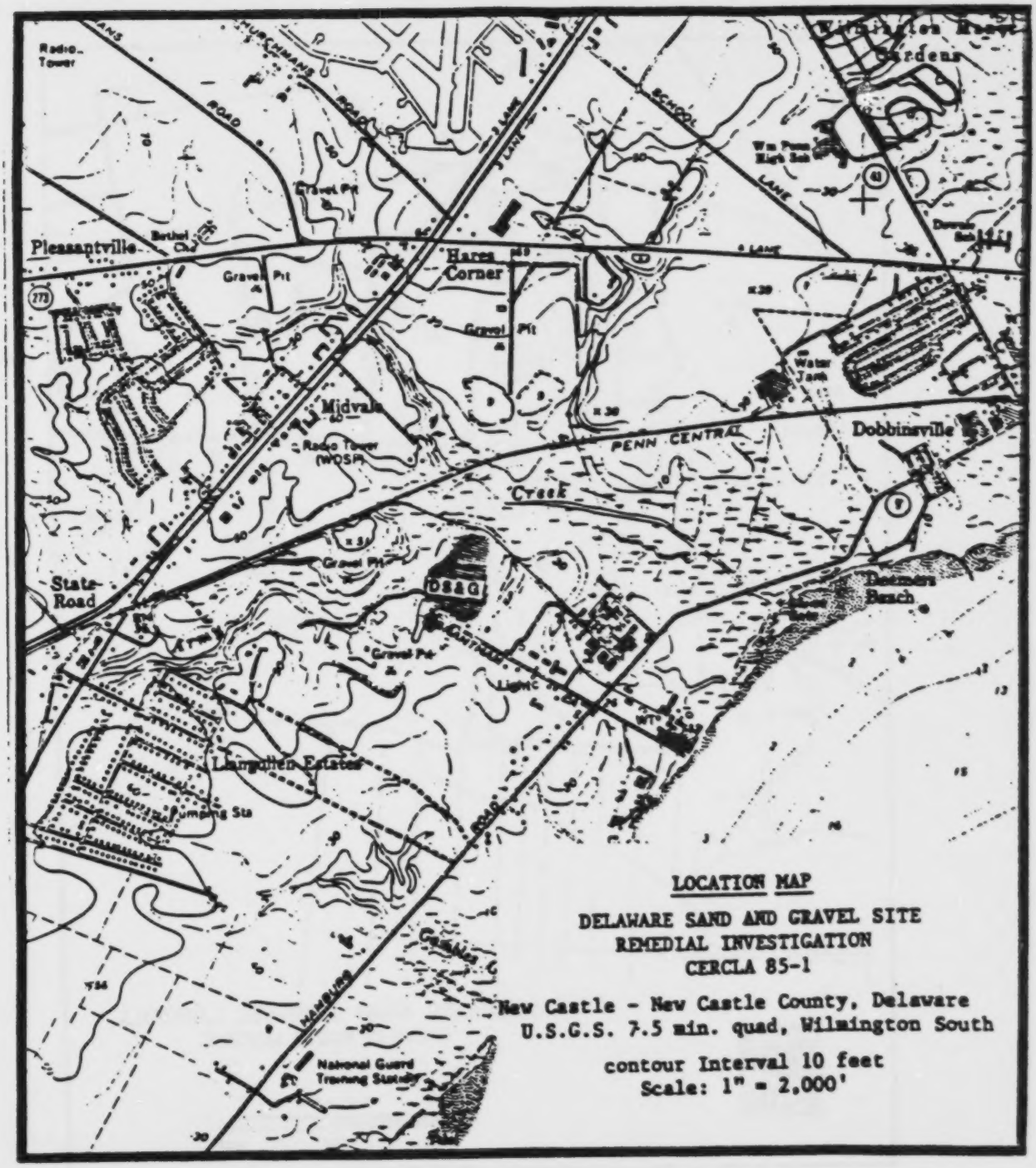

Figure 1.1

Location map for the Delaware Sand and Gravel Landfill (DS&G)

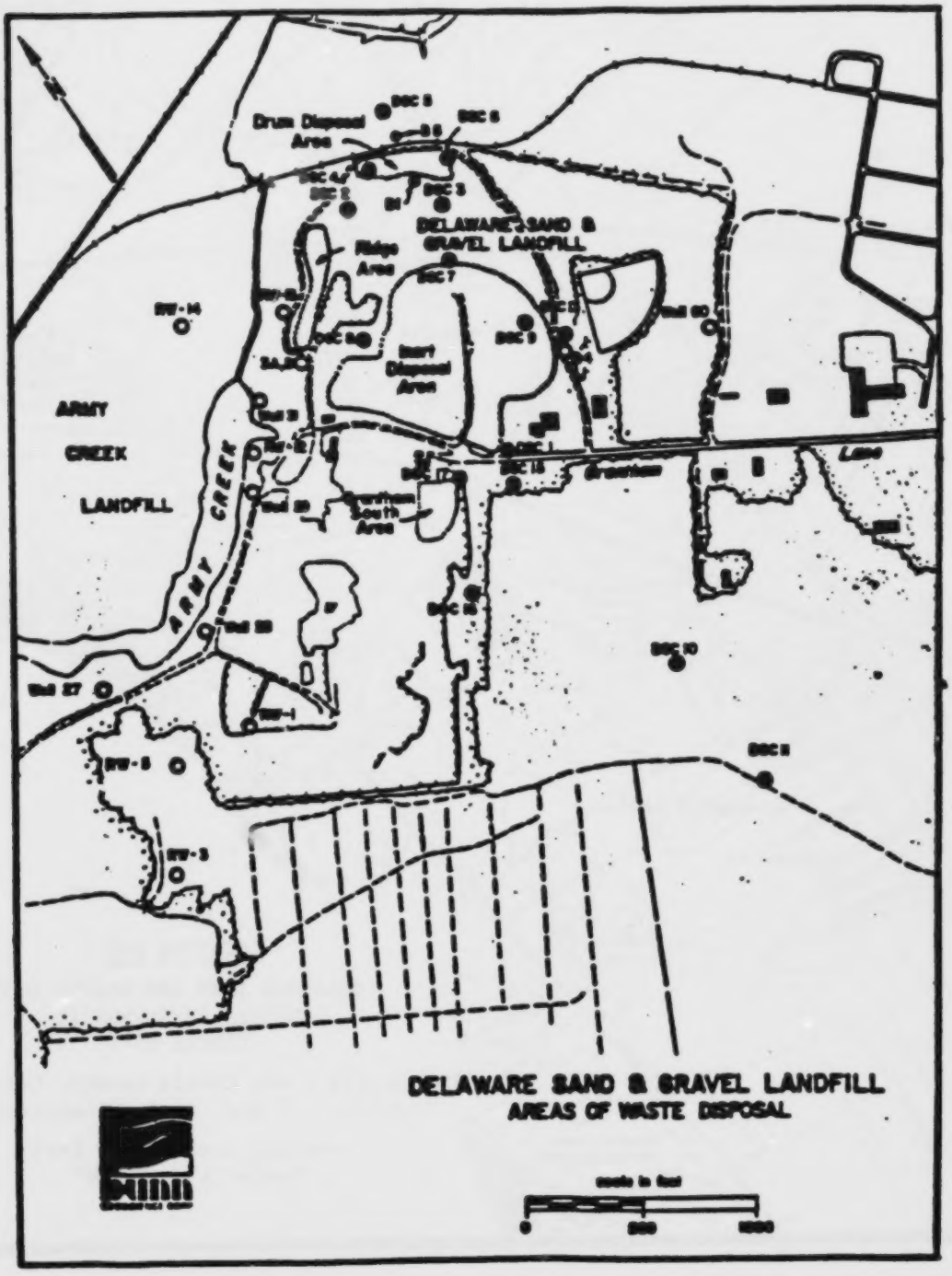

Figure 1.2: Areas of waste disposal in the DS&G Landfill.

In response to the contamination problem from the Army Creek landfill, New Castle County installed a groundwater recovery system designed to prevent the movement of contaminants towards the Artesian Water Company wellfield by maintaining a groundwater divide. The groundwater recovery system has operated for 12 years and is operating today successfully capturing groundwater contamination from Delaware Sand and Gravel.

Investigations characterizing the source of contamination and extent of contamination continued for both the Delaware Sand and Gravel and Army Creek Landfill. In the spring of 1984, EPA/DNREC performed an emergency removal. After removal of approximately 600 drums from the surface of the Drum Disposal Area, the removal action was discontinued and the area was covered and revegetated.

A Remedial Investigation (RI) and Feasibility Study (FS) centering on Delaware Sand and Gravel (DS & G) began in the fall of 1984. The RI was completed in December of 1987 and the FS in February of 1988.

III. ENFORCEMENT HISTORY

In 1975 the DNREC began enforcement action against the Delaware Sand & Gravel Company, which owned and operated the landfill, for violations of the State Solid Waste Permit. Specific violations include improper operating procedures such as poor cover and compaction. The enforcement action was initiated as two civil suits which are pending litigation.

Nineteen Potentially Responsible Parties (PRP's) were identified in the June 22, 1985, EPA Final Potentially Responsible Party Report. The PRP's were contacted by telephone prior to the March 16, 1988, RI/FS public meeting. The PRP's were also sent CERCLA 106 letters on March 22, 1988, pursuant to 106 of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC 9601.

In order to allow the PRP's reasonable opportunity to comment and provide information, the public comment period was extended from March 26, 1988, to April 18, 1988.

IV. SITE CHARACTERISTICS

A. GEOLOGY/HYDROLOGY

Geologically, DS&G is within the Atlantic Coastal Plain physiographic province. The coastal plain is a stratified, seaward thickening wedge of unconsolidated and semi-consolidated sands, silts, clays, and gravels deposited atop a seaward sloping complex of crystalline basement rock. In the Army Creek area, the Quaternary (Pleistocene) Columbia Formation occurs as a veneer over the seaward dipping Cretaceous-aged Potomac Formation. Quaternary (Recent) alluvial deposits occupy current streams and tidal marshes. Depths to bedrock range from 400 to 650 feet below land surface.

The contact between the Quaternary (Columbia) sediments and the Potomac Formation is an erosional and angular unconformity. Figure 1.3 is a contour map depicting the base elevation of the Columbia Formation which is also the top of the Potomac Formation. Usually, a dense red clay marks this contact. This clay (the Uppermost Potomac confining clay) is believed to be absent in two areas: one, at the subcrop/recharge zone for the Upper Potomac Hydrologic Zone about one mile northwest of DS&G; and two, between Army Creek Landfill and DS&G as a small hole or window as shown in Figure 1.4. This window is the likely pathway for contaminants entering the Upper Potomac Hydrologic Zone.
The Quaternary sediments comprise the shallow water-table aquifer which is essentially dewatered at DS&G. The Potomac Formation has been interpreted to include three artesian aquifers. The uppermost Potomac aquifer, called the Upper Potomac Hydrologic Zone (UPHZ), is the aquifer of concern in this investigation, especially the top portion which is referred to as the upper Upper Potomac.

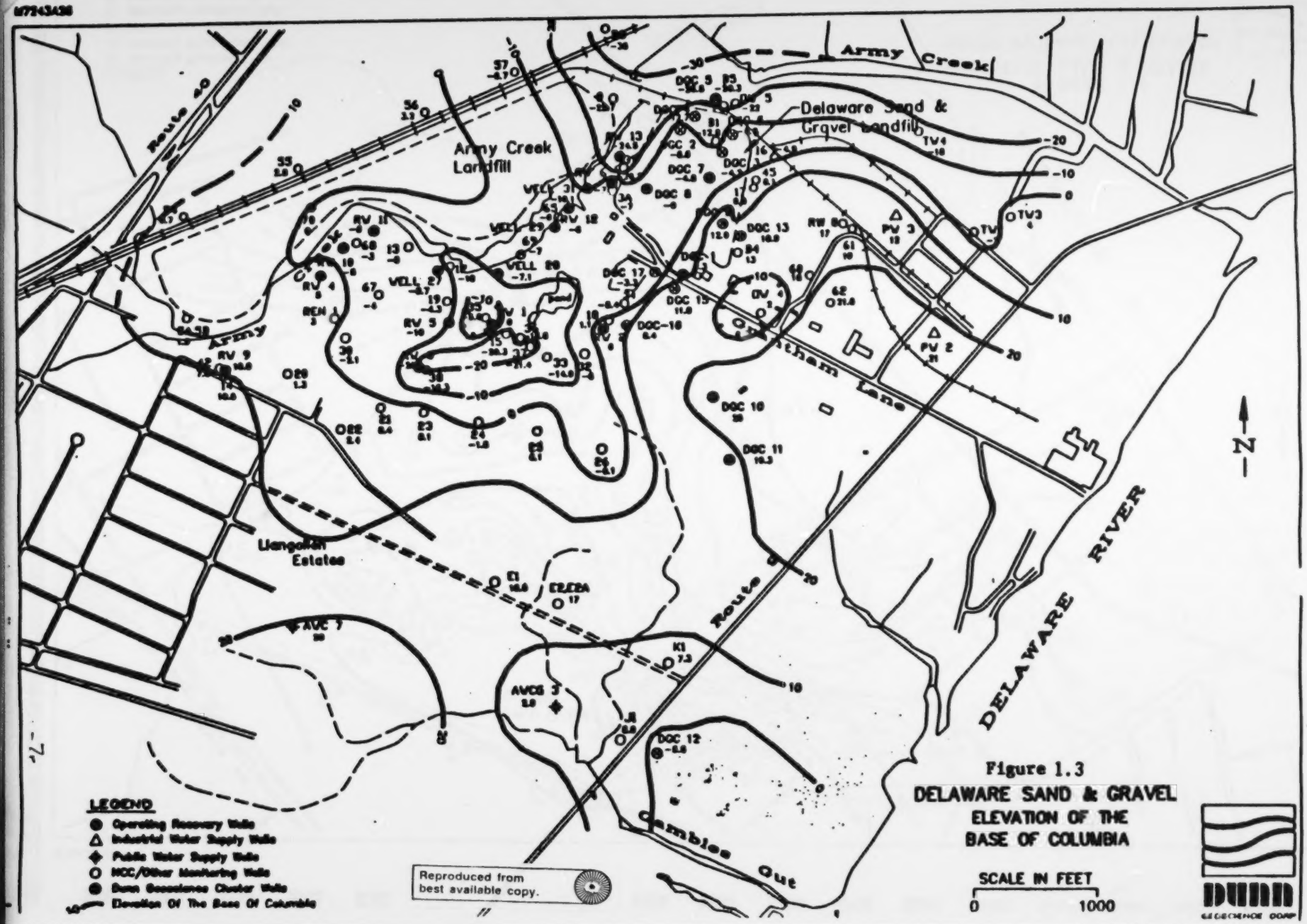

Figure 1.3
DELAWARE SAND & GRAVEL
ELEVATION OF THE
BASE OF COLUMBIA

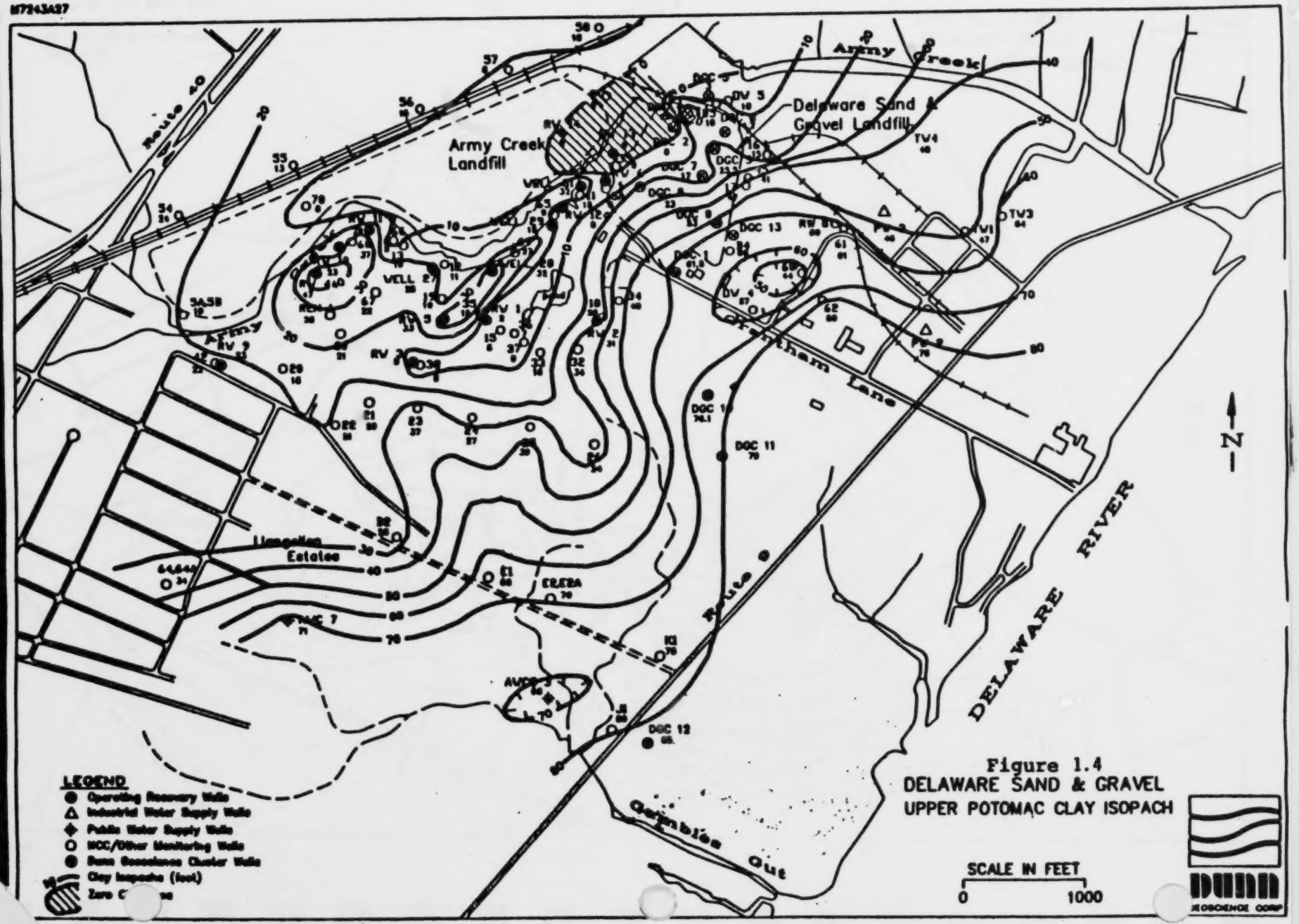

Figure 1.4
DELAWARE SAND & GRAVEL
UPPER POTOMAC CLAY ISOPACH

The groundwater within the Columbia is derived from infiltration of rain water, infiltration from Army Creek, and infiltration from the drainage ditch east of the Delaware Sand and Gravel Landfill. As such, water in the Columbia at the Delaware Sand and Gravel Landfill moves vertically downward under unsaturated conditions until it encounters the uppermost Potomac clay. Water encountering the Uppermost Potomac clay may build up to a depth of a few feet creating a saturated thickness in some locations, but within much of the Delaware Sand and Gravel Landfill, it moves as "sheet flow" on top of the clay to discharge through the zero area into the UPHZ.

The flow regime in the UPHZ near the Delaware Sand and Gravel Landfill has changed significantly over time. The major factors that have affected groundwater flow and contaminant migration from the Delaware Sand and Gravel and Army Creek Landfills have been Army Creek, the zero clay area located between the landfills, and the pumpages from the Llangollen Estates well field, the Amoco well field, and the Army Creek recovery well field.

In response to water supply and recovery well pumpage, groundwater has moved within the UPHZ to the southeast, east, south, and southwest at various times since 1952. Likewise, after waste emplacement began (1960 for Army Creek landfill; 1968 for DS&G) contamination from both landfills migrated in those different directions along with the groundwater. Since 1982 a westerly flow pattern has been predominant due to five new recovery wells installed by New Castle County.

B. NATURE OF WASTES

The Delaware Sand and Gravel landfill site was operated from 1968 to 1976. Wastes were deposited in four distinct areas on the site: the Drum Disposal Area, the Ridge Area, the Inert Disposal Area, and the Grantham South Area (Figure 1.2).

The Drum Disposal Area is located just south of the railroad tracks and occupies 0.42 acres. The area was originally a pit approximately 150 x 70 x 15 feet. It is estimated that 7,000 drums in various conditions were disposed of in this area of the site. It has been reported that many of the drums contents were emptied into the pit prior to crushing and disposing of the drums. The drums reportedly contained liquids and sludges from various industrial processes including perfume, plastics, paint and petroleum refining processes. During the surface removal operation in 1984, the majority of drum contents were characterized as organic and inorganic solids. Liquids characterized included organics and PCB's. It has been estimated this area would contain approximately 20,000 yards^3 of contaminated material.

The Ridge Area is immediately east of recovery well 13 and covers an area of 0.5 acres. Surficial wastes, drums, large storage tanks, pallets etc. are scattered on the slope and top of the ridge. Subsurface waste disposal has probably not occurred in this area. Contaminated surficial soils and surface wastes in the Ridge Area are estimated at 9722 yards^3.

The Inert Disposal Area is approximately 10.7 acres and is topographically the highest waste disposal area on site. This area is estimated to contain approximately 432,000 yards^3 of waste material. Much of the waste is believed to consist of wire, hose, twine, cork dust, tires, cardboard and styrofoam. Cars, trucks, trailers, buses, storage tanks, domestic wastes, etc. scatter the surface of the Inert Disposal Area.

The Grantham South Area is located on the southern side of Grantham Lane. Disposal of wastes in this area is uncertain, however it is believed inert waste as well as scattered chemical wastes were deposited in this area. The area surface is mostly ash and resinous waste product. There is little soil cover. Based on a topographic map, this area is approximately 35 feet thick and contains approximately 73,400 yards^3 of soil and waste.

C. EXTENT OF CONTAMINATION

The following is a summary of the extent to which various media (air, surface soils, formation soils, surface water, stream sediments, and groundwater) are contaminated at the site.

Surficial Soils

- The analytical results for the surficial soils indicate only isolated "hot spots" with significant concentrations of organics and metals on both the Ridge and Grantham South areas.

  Surficial soils are not a concern at the Drum Disposal Area because of the removal action in 1984, which removed surface drums, covered the area and revegetated. Also the Inert Area is not a concern for surficial soil contamination.

  In the Ridge Area, sampling detected "hot spots" of metals and organics. Tables 5.11 and 5.12 in Appendix A summarizes the inorganic and organic constituents detected in the surface soils of the Ridge Area. Metals detected above background included arsenic, antimony, barium, copper and lead. The major organic detected was PCB's at concentrations from 97 ppb to 49,000 ppb. Contractor personnel noticed several corroded barrels and some spilled product in the Ridge Area and sampled some of the spilled product at sampling location R-14s. Soil 2 feet below the spilled product (sample R-14d) was not contaminated, indicating that the contamination had not leached vertically 2 feet into the soil profile and suggesting that migration of the surficial soil contaminants may not be a large concern.

  Grantham South Area sampling revealed two "hot spots" of organics (G-01d and G-03d). Tables 5.11 and 5.12 in Appendix A summarize the organic and

inorganic constituents detected in the suface soils of the Grantham South Area. Organics were not of concern in the surficial soils of the Grantham South Area. Almost every other sample had increased metals concentrations (especially copper, lead, nickel, and zinc).

Formation Soils

- The analytical data for the split-spoon samples indicate that organic and metal contamination is emanating from the DS&G Drum Disposal Area and that some metal contamination is possibly emanating from the Inert Disposal Area. Organic compounds were detected in soil boring samples collected from:

  1. the Drum Disposal Area proper (DGC-6);
  2. the base of the Columbia Formation close to the Drum Disposal Area (DGC-4);
  3. the uppermost Potomac silty clays beneath and adjacent to the Drum Disposal Area (DGC-4); and
  4. the top portion of the upper Upper Potomac sands (DGC-4, DGC-7, DGC-8).

  Organic compounds detected in formation soils included, toluene, methylene chloride, Acetone, 4-Methyl-2 Pentanene, ethylbenzene, 1-2 dichloroethane, xylene, phenol, bis (2-chlor-ethyl) ether, napthalene, 4-Methylphenol,, 2-Methylphenol and 2-Butanone. Also, Columbia Formation samples generally have increased metals concentrations (chromium, lead, and nickel in DGC-4, DGC-6, DGC-8 and DGC-9). In general, the formation soil chemistry mimics the groundwater chemistry in extent and nature. Apparently, contamination is migrating with the groundwater and adsorbing onto the soils. Organic and Inorganic Analytical Results for soil boring sampling are presented in Table 5.14, 5.15, and 5.16.

Surface Water and Stream Sediments

- Water and sediments from Army Creek, the Gravel Pit pond, and the intermittent stream east of DS&G are not significantly degraded due to the landfills. Organics were not detectable in either water or sediments. In water, the only detectable metals are iron, manganese, magnesium, and to a lesser extent, barium. For stream sediments, analytical results for metals are similar to the surficial soil metals data. Iron and manganese concentrations are predominant and at the same order of magnitude as the surficial soils. Lesser concentrations of barium, chromium, zinc, lead and copper are also present in the surficial soils. Additionally, mercury, arsenic, selenium and beryllium were detected at very low concentrations. Thallium, antimony, cadmium and silver were not detected. Inorganic Analytical Results for surface water are summarized in Table 5.17 and 5.18.

In general, Army Creek is the primary concern in terms of surface water and stream sediments. However, the impacts of the landfills and the recovery well discharges on Army Creek do not appear significant and distinct trends in the surface water quality from upstream to downstream of the landfills are not apparent. To further evaluate the environmental status of Army Creek, a biomonitoring survey of Army Creek was performed by EPA to evaluate the impacts of the landfills on the biota in the stream. The results indicate there is stress on aquatic life in Army Creek. The creek water, in general, has been degraded below normal surface water. However, the organisms in the creek are stressed more upstream of the landfills. That is, both the benthic survey and the aquatic chronic toxicity test have shown that the water in the Army Creek upstream of the landfills is of poorer quality than the downstream

segment. Sediment toxicity tests have detected chronic toxicity in the pond stations.

Although the water that is pumped from the recovery wells is degraded compared to typical well water in the area, and chronic toxicity was detected in Army Pond Sediments, the benthic data indicated no adverse effects to Army Creek due to the landfills or the recovery wells. The Army Creek environment though is very complicated. For example, the Army Creek pond habitat is different from the upstream and downstream creek segments. The Army Creek pond is eutropic and the benthic community there is dominated by pollution tolerant organisms. The pond tends to act as a treatment system so the quality of the pond effluent is better than the pond influent. Regardless, the water quality of the creek, extending from the upstream to the downstream station, is all degraded.

Further bioassay studies to continue to monitor the situation will be completed as a requirement of The National Pollution Discharge Elimination System permit issued to New Castle County in 1987.

Groundwater

- Analytical results from the groundwater sampling indicate the quality of groundwater in the Upper Potomac Hydrologic Zone in the vicinity of DS&G has been degraded. The data indicate that the shallower portion of the UPHZ, the upper Upper Potomac, is of poorer quality than the deeper, lower Upper Potomac. Further, a distinct plume has been identified in the upper Upper Potomac for organics and metals which emanates from the DS&G Drum Disposal Area southwestward toward recovery wells RW-13, 31, RW-12, 29 and 28. The predominant contaminants identified in this plume are benzene, toluene, xylenes, ethyl benzene, bis (2-chloroethyl) ether,

MIBK, MEK, iron, and manganese. Individual plumes for benzene, toluene, and xylenes in the upper UPHZ are shown in Figures 1.5 through 1.7. Concentrations of these compounds in groundwater from the lower Upper Potomac were too low to be contoured.

Organic and metal contamination were detected in a few lower Upper Potomac wells at very low levels. The wells that have shown organic contamination are all located in the immediate vicinity of the Drum Disposal Area.

Organic and Inorganic analytical results for groundwater sampling are presented in Table 5.22 and 5.23.

Though not the only source, the DS&G Drum Disposal Area is apparently the major source of organic groundwater contamination, in the vicinity of Army Creek. Inorganic contamination from both DS&G and Army Creek Landfill is also evident, however, organics predominate DS&G contamination and inorganics seem to predominate Army Creek Landfill contamination.

Air

- Air monitoring indicates that ambient air quality degradation is not a concern with respect to volatile organics in the vicinity of DS&G during non-disruptive on-site activities and that adverse health effects due to gaseous emissions from the DS&G site are not expected. Natural atmospheric dispersion at the site is sufficient to decrease concentrations of gases emitted from the landfill to below detectable and harmful limits. These conclusions are supported historically and by the results of the Remedial Investigation (Ecology and Environment, Inc., 1982b; NUS Corporation, 1983b; and Weston, 1986).

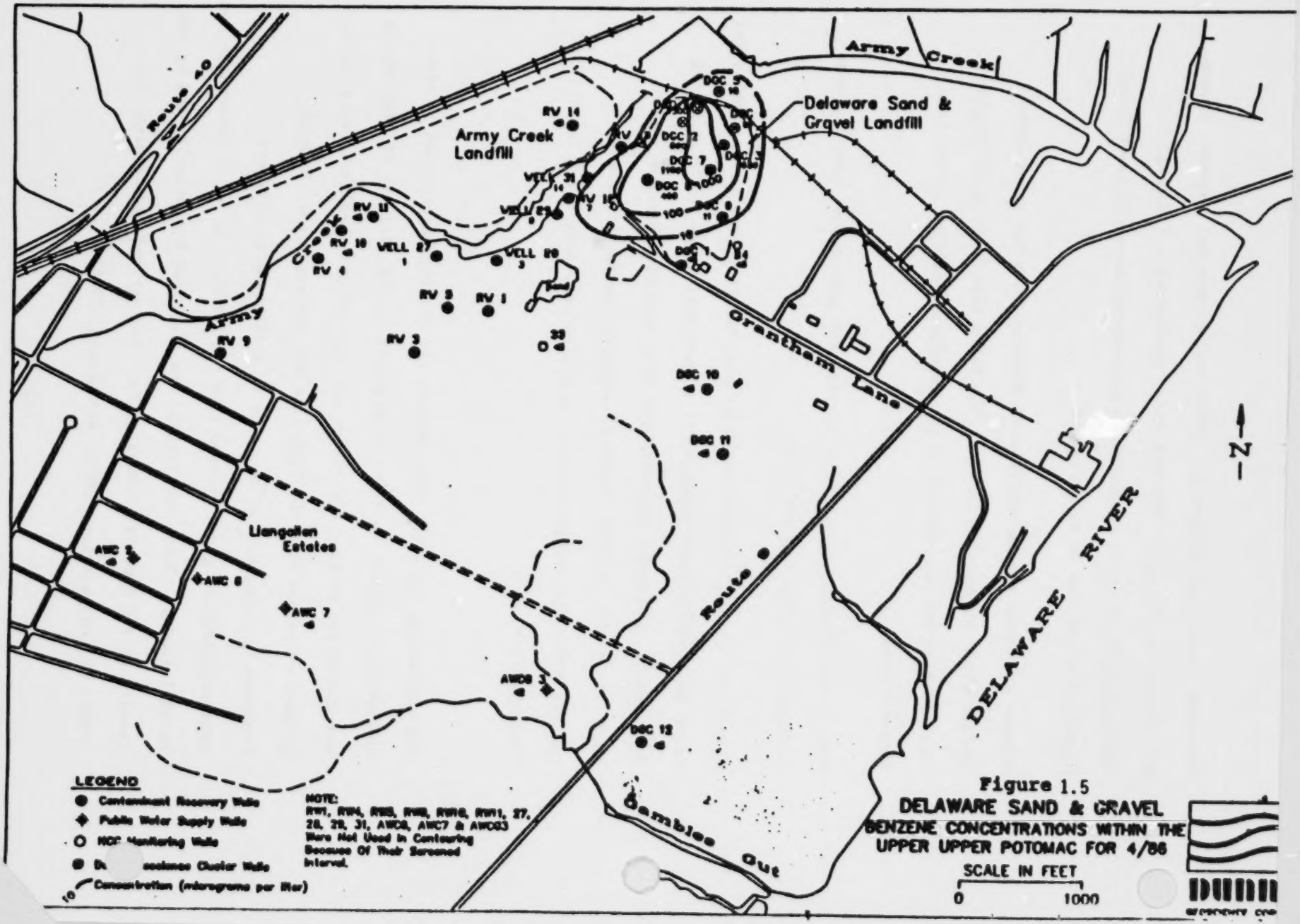

Figure 1.5
DELAWARE SAND & GRAVEL
BENZENE CONCENTRATIONS WITHIN THE UPPER UPPER POTOMAC FOR 4/86

M7243A3

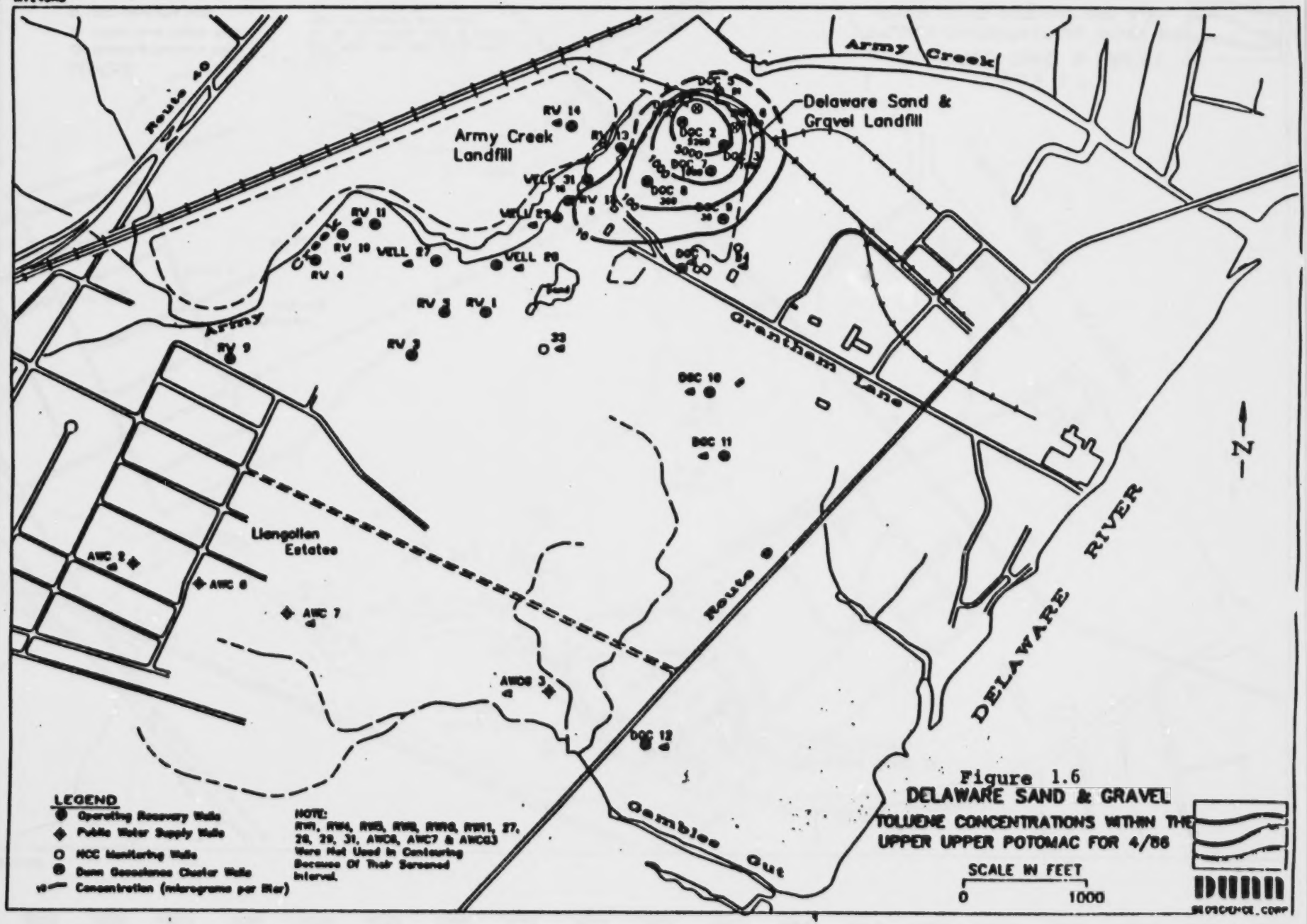

Figure 1.6
DELAWARE SAND & GRAVEL
TOLUENE CONCENTRATIONS WITHIN THE UPPER UPPER POTOMAC FOR 4/88

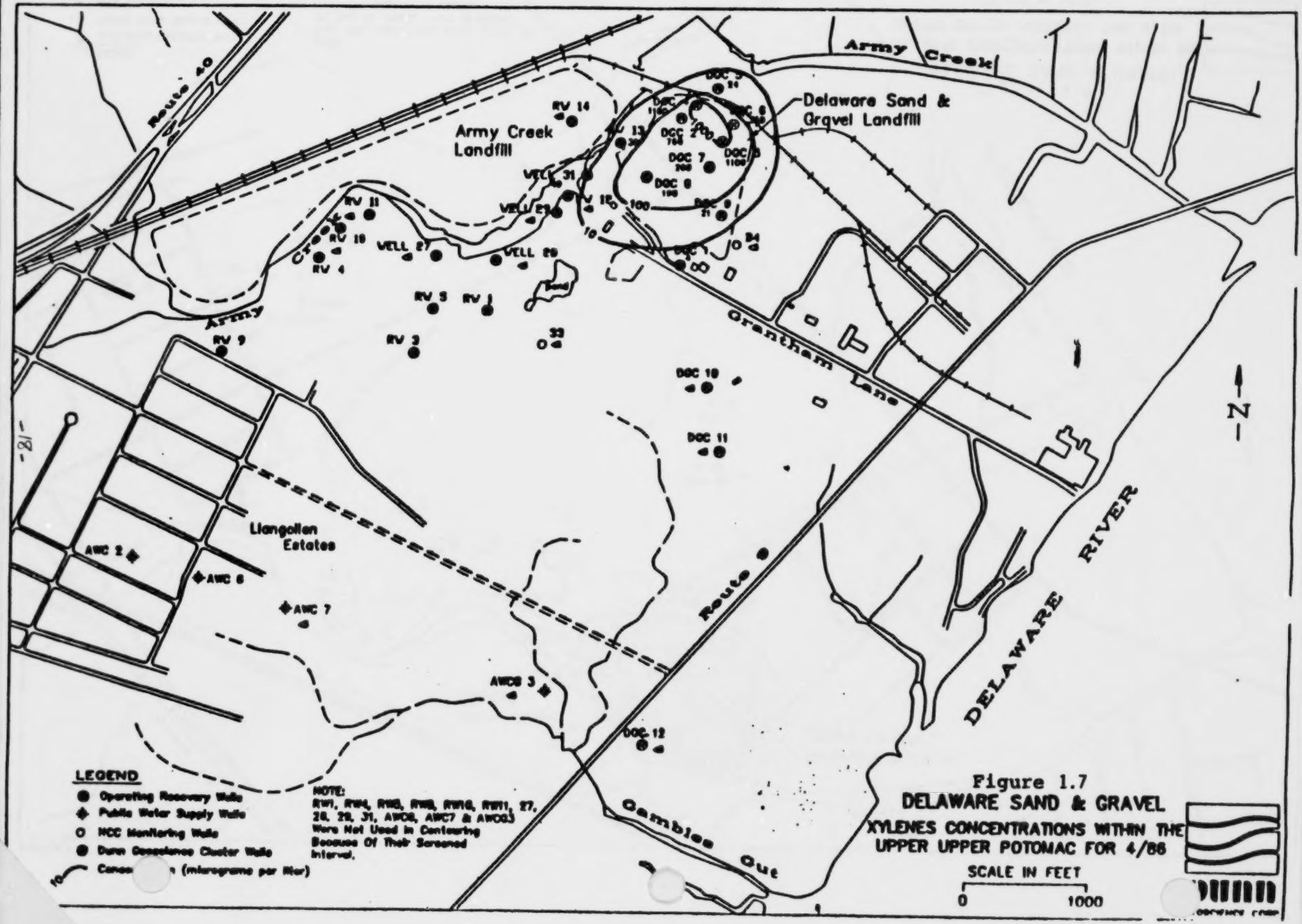

Figure 1.7
DELAWARE SAND & GRAVEL
XYLENES CONCENTRATIONS WITHIN THE UPPER UPPER POTOMAC FOR 4/86

Ambient, open-air, total volatile organic concentrations measured during this investigation at the DS&G Drum Disposal, Inert Disposal, Ridge, and Grantham South areas were the same as off-site background levels (about 1 ppm). Most ambient open-air concentrations measured while drilling were at background levels; a few readings at DGC-6 were slightly above background levels. None were higher than 2ppm.

Higher total volatile organic concentrations were detected during drilling operations immediately upon opening some of the split spoons from borings DGC-2 through DGC-9. These higher concentrations, however, represent deep soil or groundwater quality, not ambient air quality.

D. SUMMARY OF SITE RISKS

After evaluating the extent of contamination, the risks were characterized for each potential or existent exposure pathway. Since no significant air or surface water and sediment contamination was detected, it was determined no risks were posed by these media. The following three areas were found to present potential risk to the public health and the environment.

Risk posed by Groundwater Ingestion

Groundwater in the upper Upper Potomac Hydrologic Zone is contaminated by leachate emanating from the Drum Disposal Area. Groundwater contamination has migrated away from the Drum Disposal Area; however, the current recovery well pumping scenerio prevents DS & G contaminants from migrating to any known water supply sources.

Consequently groundwater ingestion risks were calculated on the potential exposure though development of domestic wells installed within or on the site boundary.

Groundwater from DS&G monitoring wells (DGC-02d, DGC-02s, DGC-04, DGC-05 and DGC-06) is unsafe for human consumption due to carcinogenic and non-carcinogenic risks while groundwater from Army Creek recovery wells (RW-13, 31, RW-12, and 29) is unsafe for human consumption due only to carcinogenic risks. (See table 1 thru table 4).

Risk posed by soil ingestion, inhalation and dermal contact

- Organic and Inorganic surficial soil contamination was detected in the Ridge and Grantham South areas. Only PCB's and arsenic were found to constitute a carcinogenic risk in surficial soils while lead, antimony, copper, and barium constitute non-carcinogenic risk. Based on available data, all risk posed by soil ingestion/inhalation appears limited to the Ridge Area. Associated Risks are summarized in Table 14.

- Surficial soils contamination in the Drum Disposal Area is nonexistent due to the removal, regrading and soil cap completed in 1984 at this disposal area.

Risks posed by site access

- Physical injury resulting from uneven terrain, industrial scrap, protruding waste, etc. remains a concern at the site. The site is accessable from the east, and south. Also, while public water supply wells have not been compromised due to groundwater contamination, the recovery well discharge does present a direct contact risk.

TABLE 1

Total Carcinogenic Risks (Oral and Inhalation)
From Contamination Found at the Recovery Wells
(Based on April 1986 Sampling)

Recovery Well Number	* Risk Factor	Primary Constitutent(s) of Risk Factor	Additional Cancer Case Ratio
RW-13	1.2×10^{-4}	bis(2 chloroethyl) ether	1 in 10,000
RW-31	4.4×10^{-4}	benzene bis(2 chloroethyl) ether	1 in 2,300
RW-12	1.1×10^{-4}	benzene bis(2 chloroethyl) ether	1 in 10,000
RW-29	1.1×10^{-3}	bis(2 chloroethyl) ether	1 in 1,000

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TABLE 2

Total Carcinogenic Risks (Oral and Inhalation)
From Contamination Found at the MonitoringWells
(Based on April 1986 Sampling)

Monitor Well Number	Risk Factor	Primary Constitutent(s) of Risk Factor	Additional Cancer Case Ratio
DGC-02d	1.6×10^{-5}	benzene	1 in 100,000
DGC-02s	1.1×10^{-2}	benzene bis(2 chloroethyl) ether	1 in 100
DGC-04	4.6×10^{-2}	bis(2 chloroethyl) ether 1,2-dichloroethane methylene chloride	1 in 20
DGC-05	4.0×10^{-5}	benzene	1 in 25,000
DGC-06	2.2×10^{-5}	benzene bis (2 chloroethyl) ether 1,2 - dichloroethane	1 in 500

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TABLE 3

Total Non-Carcinogenic Risks (Oral and Inhalation)
From Contamination Found at the Recovery Wells
(Based on April 1986 Sampling)

Note: Values greater than 1 indicate risk

Recovery Well Number	Risk Factor	Primary Constitutent(s) of Risk Factor	Risk Posed
RW-13	0.077	xylenes	No
RW-31	0.143	benzene xylenes	No
RW-12	0.044	chlorobenzene	No
RW-29	0.195	benzene chlorobenzene	No

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TABLE 4

Total Non-Carcinogenic Risks (Oral and Inhalation)
From Contamination Found at the Monitoring Wells
(Based on April 1986 Sampling)

Note: Values greater than 1 indicate risk

Monitor Well Number	Risk Factor	Primary Constitutent(s) of Risk Factor	Risk Posed
DGC-02d	0.029	toluene xylenes	No
DGC-02d	13.082	toluene xylenes MEK MIBK	Yes
DGC-04	15.544	toluene xylenes styrene MIBK phenol	Yes
DGC-05	0.084	toluene xylenes	No
DGC-06	7.099	ethyl benzene toluene xylenes MEK	Yes

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TABLE 5

Inorganics Detected in Selected Surficial Soil Samples
and Their Associated Risks

	Ingestion/Inhalation				
	R-07	R-14s	R-08	R-09d	R-12
Antimony (Sb)	2.1	8.97	1	-----	----
Barium (Ba)	1.83	1	1	-----	----
Copper (Cu)	1	6.93	1	-----	----
Lead (Pb)	54.4	1.85	4.5	-----	----
Arsenic (As)*	1.23E-02	5.43E-02	6.14E-03	-----	----
PCB*	1.49E-04	4.85E-03	-----	1.88E-05	9.61E-06

*considered as a carcinogen with appropriate risk level

+100% absorption is assumed

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3/88

V. COMMUNITY RELATIONS HISTORY

The DS&G Landfill is located in a sparsely populated and lightly industrialized area south of the city of New Castle. Along Grantham Lane there are about ten domestic residences, a private health club, some small commercial businesses, the State of Delaware Division of Air and Waste Management office and a small tavern. There are other residences and small businesses south of Grantham Lane along Route 9 and the Llangollen Estates housing development is about a mile southwest of DS&G.

Residents were invited to 3 public meetings involving the Delaware Sand and Gravel site. One prior to the Emergency Removal in the spring of 1984, one prior to the initiation of The Remedial Investigation/Feasibility Study in the fall of 1984 and one on March 16, 1988 to solicit comments on the Proposed Plan. Attendance at these meetings has been less than 25 people and no outstanding resistance to activities at the site has been brought to DNREC or EPA's attention. A public comment period starting February 26, 1988 and continuing to April 18, 1988 was utilized to solicit comments from the public regarding the proposed plan.

The DNREC has attempted to respond to all the comments, in the Responsiveness Summary which is attached.

VI. REMEDIAL ALTERNATIVE OBJECTIVES

Objectives identified for this study included the following:

1) Select a remedy that is protective of human health and environment
2) Select a cost effective remedy.
3) Select a remedy that will attain State and Federal Applicable, Relevant and Appropriate Requirements upon completion.
4) Select a remedy that uses permanent solutions and alternative technologies to the maximum extent practicable.
5) Select a remedial alternative which prefers treatment of the principal threat to reduce mobility, toxicity and volume of the hazardous waste.
6) Select a remedy that provides best results across all evaluation criteria.
7) Ensure the chosen groundwater remedial alternative is compatible with the selected Army Creek Landfill groundwatr alternative.

In approaching these goals, the NCP, 40 CFR 300.68 (F), requires that at least one alternative from each of the following categories be evaluated within the requirements of the feasibility study guidance (EPA, 1985).

1) Alternative for treatment or disposal at an off-site facility;
2) Alternative which attains applicable or relevant and appropriate Federal public health or environmental standards;
3) Alternative which exceeds applicable or relevant and appropriate public health or environmental standards;
4) Alternative which does not attain applicable or relevant and appropriate public health or environmental standards but will reduce the likelihood of present or future threat from the hazardous substances;
5) No action alternative.

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Alternatives were assessed on how adequately they met the above referenced goals and objectives. The alternatives were assessed using the following eight criteria. These criteria were developed based upon the requirements of Section 121 of CERCLA, amended by SARA.

1) Overall Protection of Human Health and the Environment - All alternatives were assessed from a standpoint of whether they provided adequate protection of human health and the environment.
2) Compliance with Applicable, or Relevant, and Appropriate Requirements (ARAR's) - Alternatives were assessed as to whether they attained legally applicable or relevant and appropriate requirements of other Federal and State environmental and public health laws.
3) Long-term Effectiveness and Permanence - Alternatives were assessed for the long-term effectiveness and permanence they afford along with the degree of certainty that the remedy will prove successful.
4) Reduction of Toxicity, Mobility or Volume - Alternatives which employ treatment were evaluated for their reduction of toxicity, mobility or volume.
5) Short term Effectiveness - Alternatives were assessed on how effective they were on a short term basis.
6) Implementability - Alternatives were assessed on the technical and administrative considerations of actually implementing the alternative.
7) Community Acceptance - Alternatives were assessed on predicted community attitudes and actual responses toward the alternatives.
8) Cost - Alternatives were also assessed on various types of costs to be incurred with each alternative.

Alternatives reaching the detailed evaluation are listed in Table 6 below per Disposal Area and Groundwater Plume Management.

DSAG Remedial Action Alternative Packages for Detailed Assessment
3/21/88

Drum Disposal Area and Ridge Area	Inert Disposal Area	Grantham South Area	Groundwater
- No Action	- No Action	- No Action	- Status Quo - No Further Action
- Removal and Off-site Disposal	- Surface Debris Removal and Capping	- Capping	- Status Quo - Plus Treatment
- Removal and On-site Incineration			- Cease Present Recovery Well System
- Removal, On-site Incineration, and Bioreclamation of Soils			

VII. ALTERNATIVE EVALUATION

A. SOURCE CONTROL

Drum Disposal Area and Ridge Area

- Alternative 1. - No Action - The reason for evaluating a No Action Alternative is to provide a basis for comparison of existing conditions with other proposed remedial alternatives. The No Action alternative for the Drum Disposal Area and Ridge Area would result in no additional remediation in these areas.

  The Drum Disposal Area is the primary source of groundwater contamination and the Ridge Area is the primary source of soil contamination on the site. Groundwater contamination emanating from the Drum Disposal Area has not had a direct impact on the production wells in Artesian Water Company wellfield (present receptors); however, contaminants in the upper upper potomac groundwater aquifer have been detected above acceptable levels (MCL's or 10^{-6} risk levels at the site boundary.) Surficial soil contamination in the Ridge Area has also been determined to present a direct contact risk.

  By leaving the wastes in place, compliance with MCL's at the site boundary (assuming groundwater contaminant recovery system continues.) is estimated to be over 30 years. Also if wastes are not removed or treated contaminated surficial soils would continue to present a direct contact risk.

  The no action alternative would not reduce volume, toxicity or mobility of the wastes located in the Drum Disposal and Ridge Area.

Over the short-term the effectiveness of the no action alternative is obviously poor. No reduction of the potential groundwater ingestion risk or the surficial soil direct contact risk would occur. Over the long-term the potential groundwater ingestion risk may be reduced after an additional 30 years of operating the groundwater contaminant recovery system.

No cost would be incurred with this source control remedy. Community acceptance of the alternative would more than likely be negative since the alternative presents no improvement over present site conditions.

- Alternative 2. - Removal and off-site disposal - This alternative involves waste characterization in both areas and excavation of the waste and contaminated soils in the drum disposal area and contaminated surficial soils from the ridge area. No treatment of wastes and soils would occur with this alternative. Wastes and contaminated soils would be transported to an off-site land disposal facility.

This alternative would be required to meet Resource Conservation and Recovery Act transportation and disposal requirements. Land disposal restrictions under subtitle C of RCRA are expected to negatively affect this alternative. After November of 1988, it will be difficult to comply with land disposal restrictions of the wastes and contaminated soils unless treatment is utilized prior to disposal.

This alternative involves handling approximately 36,000 tons of wastes and contaminated soils that have been on-site and compacting for several years. Disturbing these materials will likely cause bulking, an increase in volume. Removal and disposal without treatment do nothing to

reduce the waste's toxicity. Likewise, nothing would be done to decrease the waste's mobility while on-site; instead, the waste would be removed from the site altogether.

The short-term effectiveness is only fair. While the remedy works to reduce the risks, the community and, especially, the workers face increased exposure risks during waste removal, characterization, transportation, and redisposal. This increased exposure period, however, is short-lived. Once the waste has been removed and redisposed off-site, there is minimal potential of future releases. The long-term effectiveness, thus, would be good, and since the wastes are actually removed from the site, the solution offers a high degree of permanance relative to on-site conditions.

Implementation of this alternative would be technologically and operationally straightforward. Transportation permits and off-site disposal arrangements would be necessary. Excavation equipment and operators could be arranged for by the time off-site action permitting would be complete. No major construction would be necessary to implement this alternative. Overall, its implementability is good.

Proposing a removal and off-site disposal action for the Drum Disposal Area and the Ridge Area would result in mixed community reaction. Though residents would react adversely to the transportation of hazardous wastes through their communities, they would support the total removal of the wastes from their area. Overall community acceptance, then, should be good.

Costs for this alternative for the Drum Disposal Area and for the Ridge

Area total approximately $20,250,000. Waste Characterization and Excavation for the Drum Disposal Area and the Ridge Area is estimated at $3,250,000. Off-site disposal of the excavated waste is estimated at approximately $17,000,000. No operation and maintenance costs would be involved with this source control alternative. This alternative is most expensive of the four source control alternatives evaluated for the Drum Disposal and Ridge Area.

- Alternative 3 - Removal, On-Site Incineration - Under this alternative wastes would be removed from the ridge and drum disposal area as in Alternative 2. Treatment of wastes and contaminated soils would occur via on-site incineration. Soils and waste in the Drum Disposal Area would be excavated to a level where the leachate emanating from them to the groundwater no longer poses an unacceptable long term carcinogenic risk. These levels have been calculated and are presented in Table 7, Column IV.

  Surficial Soils and waste in the ridge area would be excavated to approximately 5 feet in depth to ensure no residual contamination.

  Incineration of the material, approximately 36,000 tons, would be conducted with a mobile incinerator. The most appropriate type of incinerator would be determined during the remedial design. The estimated time frame for incineration is 3 to 5 years. All emissions from the incineration operation would meet Air Pollution Control Regulations as well as RCRA Regulations. Residual ash, would be sampled to determine remaining constituents followed by appropriate disposal of ash.

While permits are not required for on-site remedial actions at Superfund Sites, any action must meet the substantive technical requirements of the permit process. The incineration unit would comply with all the applicable requirements of 40 CFR Part 264 Subpart O of RCRA, and also Air Quality Control regulations.

This alternative in conjunction with continued operation of the groundwater contaminant recovery system would assist in meeting MCL's at the site boundary. The estimated time frame for reaching acceptable levels of contaminants in groundwater is less than ten years after removal

While this remedy eventually reduces the risks to the public, the short-term effectiveness is only fair. The community and the workers face increased exposure risks, while on-site; however, these risks would be mitigated through proper health and safety programs and site access restrictions.

Once the wastes have been incinerated, the residual risk and the potential of future releases include only those related to the ash from the incineration process. Operation and maintenance of the incinerator would continue as long as it is in use, but with proper training and health and safety programs, associated risk would be minimized. Overall, the long-term effectiveness of this package would be good.

The permanence of this remedy would be good to excellent. All the wastes from the Ridge Area and the Drum Disposal Area would be fed to the incinerator and most would be destroyed. Only residual ash would need to be disposed of on or off-site, and since contaminant content would be low, post-disposal management would be minimal.

Table 7

Compound	Acceptable Water Exposure (ug/l)	Source	Koc	Acceptable Soil Concentration (ug/kg) [1]	Highest Soil Conc. Observed At DS+G (ug/kg)
Toluene (9)	2000	MCLG	300	6.0×10^6	1900
Methylene Chloride	0.7	CAGUCR	8.8	61.6	725
Acetone (9)	3500	SPHEM	2.2	7.7×10^4	4400
4-Methyl-2Pentanone (9)	1750	IRIS (AIC)	4.5**	7.88×10^4	3100
Ethylbenzene (9)	680	MCLG	1100	7.48×10^6	200
1,2-Dichloroethane	5	MCL	14	700	1200
Xylene (9)	2	MCL	240	4800	1100
Phenol (9)	3500	IRIS (oral) (RfD)	14.2	4.97×10^5	2100
Bis(2-Chloroethyl)Ether	0.03	10^{-6} RISK	13.9	4.17	180
Naphthalene (8)	400	ENVIRON RfD	1072[A]	4.3×10^6	4200
4-Methylphenol (9)	1750	SPHEM	264[A]	4.6×10^6	240
2-Methylphenol (9)	1750	SPHEM	*[A]	4.6×10^6	1400
2-Butanone	1750	IRIS	35	6.1×10^5	7600

[1] Acceptable soil concentrations calculated from product of acceptable water exposure and koc value, followed by ten-fold allowance for dilution, i.e. (Acceptable water Exposure) x (Koc) x (10)

A = Koc calculated from koc/kow relationships reported in Lyman etal.(1982)
equation for napthalene: Log Koc = 1.00 Log Kow - 0.21
equation for 4-methylphenol: Log Koc = 0.544 Log Kow + 1.377

* = No Kow data available for 2-methylphenol; assume value similar to 4-methylphenol

** = No Kow data available - assume value similar to MIBK Peroxide

Incineration is technologically developed and reliable. Incinerators and storage buildings are available from several manufacturers, and both could be constructed within 6 months. Excavation equipment and operators would also be readily available. Necessary storage and disposal facilities would be on-site, so there would be no availability problems and no permit applications. All these factors affect the implementability of this remedy. In general, the implementability of this remedial package would be good.

The neighboring communities would probably view the extensive management of hazardous wastes as a hazard. The construction and operation of an incinerator close to their homes would also likely generate an adverse reaction. Therefore, community acceptance of this plan is considered marginal.

Cost estimates for this alternative for the Ridge Area total $18,250,000. Waste Characterization and Removal for the Drum Disposal Area and for the Ridge Area is estimated at $3,250,000. On-site incineration of 36,000 tons of waste and contaminated soil with a mobile incinerator and disposal of residual ash is estimated at $15,000,000. No operation and maintenance costs would occur with this source control alternative. This alternative is the least expensive of the four source control alternatives evaluated for the Drum Disposal and Ridge Area.

- Alternative 4 - Removal-On-Site Incineration and Bioreclamation of soils - This alternative is similar to Alternative 3, however, additional treatment in the drum disposal area would occur to ensure no remaining soil contamination would contribute to groundwater contamination.

Treatment of soil would be through bioreclamation of soils using microorganisms to biodegrade organic contaminants.

This alternative is the same as the previous package with the addition of bioreclamation of soils. All of the criteria that were met by alternative 3 are met or exceeded by this alternative. Specifically, soils would be treated beyond the acceptable levels listed in Table 15. With the addition of bioreclamation, the long-term effectiveness ranks good. Bioreclamation treats any contaminated material missed in removal operations, therefore assisting the groundwater contaminant recovery system in meeting MCL's at the site boundary. The insurance provided by the bioreclamation also upgrades the probable compliance with ARAR's to excellent. The implementability of this alternative is beleived to be good. Prior to implementation of bioreclamation of DS & G, lab studies are necessary to determine optimal conditions needed. Also site specific studies would be necessary to accurately predict the treatability of specific contaminants, substrate removal rates, adn overall effectiveness and performance. It is estimated that the process would be effective in reducing residual contaminants in the soil after removal has occurred.

Like the package without bioreclamation, it is beleived this package would reduce the volume, toxicity and mobility of the contaminated soils in the Drum Disposal Area. The cost estimate for this remedy is higher than that of the previous alternative to reflect bioreclamation costs. The estimate is $19,985,400. Waste Characterization and Removal for the Drum Disposal Area and for the Ridge Area is estimated at 3,250,000. Incineration and disposal of residual ash is estimated at $15,000,000.

Additional bioreclamation of contaminated soil, remaining after removal, is estimated at $1,735,400. This alternative is more expensive than alternative 3 Removal and On-Site Incineration; however it is less expensive than Alternative 2 Removal and Off-Site Disposal.

Inert Disposal Area

- Alternative 1. - No Action - The reason for presenting a No Action Alternative is to provide a basis for comparison of existing conditions with other proposed remedial alternatives. The no-action alternatives for the Inert Disposal area would result in no remedial action in this disposal area.

  This alternative would not meet the ARAR's for this area covered under 40 CFR 264 RCRA Subtitle D and Delaware Solid Waste regulations 7 Delaware Code, Chapter 60, for proper closure of a solid waste landfill.

  Since this area contributes little to no contamination problem at the site, the only short-term and long-term risk is the existing risk of physical injury from surface debris and inert wastes. Also over the long-term, the existing inert waste piles will continue to attract illegal dumping at the site.

  No costs would be incurred with the no action alternative.

  The no action alternative at the Inert Area would not change the appearance of the site and therefore would not be favored by the public.

- Alternative 2. - Surface Debris Removal and Capping - This alternative involves removing surface debris (i.e., trucks, wood debris, trash) from

the surface, regrade and apply a surface cap as per DNREC Solid Waste Regulations. This alternative would meet the ARAR's (RCRA Subtitle D and DNREC Solid Waste Regulations) for this area.

Reduction of toxicity and mobility of the waste is not a major concern at this area on site since there is not any apparent contribution to site contamination from this area. Reduction of volume of solid waste would not occur with this alternative.

The short term effectiveness of this alternative would be elimination of the physical injury risk this area poses. Over the long-term this alternative would reduce the continued illegal dumping at the site.

Surface cleanup procedures and capping are well developed, reliable, and available technologies. Because wastes to be disposed off site are not hazardous, there would be no problem arranging for a disposal facility to accept the wastes. Cleanup and capping would be completed in a year, and beneficial results would be immediate. Community acceptance of this alternative is highly favorable. The community would favor an improvement in the appearance of the landfill and also a reduction of illegal dumping in the area.

The cost of this alternative is estimated at $1,161,000 for capping the Inert Area.

Grantham South

- Alternative 1. - No Action - The reason for presenting a No Action Alternative is to provide a basis for comparison of existing conditions with other proposed remedial alternatives. The No Action Alternative in

the Grantham South Area would result in no remedial action in this disposal area. The no action alternative does not meet closure requirements under Federal and State RCRA requirements. Since it is believed hazardous wastes may be distributed randomly throughout the basically inert waste, the closure requirement under hazardous waste regulations should be met. No other regulations are applicable, relevant and/or appropriate for this area.

The no action alternative would not reduce volume, or toxicity. Since the Grantham South Area is virtually dewatered, the mobility of contaminants is low and the contribution to groundwater contamination from this area is beleived to be minimal.

The potential direct contact risk in this area would not be reduced in the short or long term with this alternative.

No cost would be incurred with this alternative. Community acceptance of this alternative would not be favorable since wastes would continue to be exposed and a direct contact risk would still exist.

- Alternative 2. - Capping - Under this alternative, the surface would be regraded and capped. The cap would comply with Resource Conservation and Recovery Act closure requirements, 40 CFR 264 RCRA Subtitle C.

Capping this area would adhere to RCRA closure requirements. No other regulations are applicable, relevant and/or appropriate for this area. This action would not reduce the volume and toxicity of wastes in this area; however the potential mobility of the contaminants would be reduced.

Capping this area would reduce the direct contact risk associated with this alternative. Capping of the area would be completed in four months. The long-term effectiveness of this remedy would be good. Potential leachate generation in this area would be prevented in the long-term.

Since capping is a well developed, reliable and available technology, the implementability of this alternative is good.

Since the alternative would alleviate both risks presented in this area, it is believed the community would accept this alternative.

The cost estimated for capping the Grantham South Area is $830,000.

B. GROUNDWATER PLUME MANAGEMENT

Groundwater Contamination Plume

- Alternative 1. - Status Quo - No further action. This alternative involves continuing the groundwater recovery system specifically wells RW 13, Well 31, RW12, Well 29, and Well 28, until acceptable risk levels are met at monitoring wells near the site boundary. The acceptable risk levels for designated contaminants detected in monitoring of recovery wells are listed in table 7 Column I. Discharge to Army Creek of recovered contaminated groundwater would continue. This alternative would continue to effectively recover contaminated groundwater from the drum disposal area at Delaware Sand & Gravel.

Federal and State ARAR's for this alternative include Safe Drinking Water Act, SDWA 42 USC 300, (MCL's or 10^{-6} risk levels for groundwater) National pollution Discharge Elimination System, CWA 40 CFR 122. This alternative would assist in meeting requirements of SDWA (i.e., MCL's) at

or near the site boundary. It has been determined however that direct discharge of recovery well ground-water would not meet the NPDES requirements.

This alternative does effect a change in the the mobility of contaminated groundwater; however, the volume and toxicity is not reduced.

Over the short-term this alternative does not reduce exposure risk at the recovery well discharge point or eliminate any potential Army Creek water quality degradation.

This alternative is implementable. It was initially implemented in 1974 by New Castle County with alterations for better contaminant recovery in 1979.

Community acceptance is fair since the recovery well system does and will continue to protect water supply wells from contamination emanating from DS&G.

The cost of this alternative is estimated at $1,081,000. Installation of the 5 recovery well system is estimated at $322,130. Operation and Maintenance of the recovery wells for an estimated 10 years is $759,613. Operation and maintenance includes quarterly sampling of at least 10 monitoring wells.

- Alternative 2. - Status Quo - Plus Treatment. This alternative includes Alternative 1 and treatment of the recovery well groundwater before discharge to Army Creek.

- The type of treatment required would be determined by the Army Creek

second operable unit Record of Decision and the Regulations on National Pollution Discharge Eliminations.

This alternative has the same ARAR's as the alternative 1; however, this alternative would meet all those requirements of SDWA and NPDES. Reduction of volume, toxicity and mobility of contaminated groundwater would occur, since treatment of groundwater would be completed under this alternative.

Reduction of risk at the recovery well discharge point or the potential risk to Army Creek would be eliminated shortly after implementation of the alternative. Over the long-term (less than 10 years after source removal) this alternative would be successful in restoring the aquifer to acceptable groundwater ingestion levels and also in restoring Army Creek.

The permanence of the remedy in restoring affected areas is good. Sludges from treatment of groundwater would be handled in an appropriate manner.

Implementability of the recovery well system is technical feasible as well as construction and maintenance of the treatment facility.

Community acceptance of this alternative would be favorable since it would reduce any potential for Army Creek degradation and eliminate direct exposure risks.

The total cost for this alternative is $4,753,000. Installation of the recovery well system and treatment plant is estimated at $1,418,948. Operation and maintenance for an estimated ten years is approximately $3,334,501. Operation and maintenance includes quarterly sampling of at

least 10 monitoring wells. This alternative is much higher than other groundwater plume migration management alternatives; however it would meet all ARAR's and be protective of human health and the environment.

- Alternative 3. - Cease Present Recovery Well System. - This alternative would result in no action for remediating the groundwater contamination plume. This alternative is included for comparison with other alternatives.

  This alternative would not meet the relevant and appropriate requirements of meeting MCL's or 10-6 risk levels at the site boundary.

  No reduction of volume, toxicity and mobility of contaminated groundwater would exist with this alternative.

  Over the short-term eliminating the groundwater recovery well system would still be protective of public health at the present day receptor; however potential groundwater users on or near the site may not be protected over the long-term. Also, model simulations show contaminated water may reach Army Creek as base flow after the cessation of recovery wells.

  Community acceptance of this alternative would be unfavorable since the cessation of the recovery well system may not be protective of public health and the environment. No major costs would be incurred with this alternative.

A qualitative evaluation of Remedial Action Alternatives as per criteria listed in Alternative Objectives sectior are presented in Table 8.

Table 8

Criteria for Selection of Remedy

3/24/88
page 1 of 2

Area of Concern	Remedial Package*	Reduction in Volume, Toxicity, and Mobility	Short-Term Effectiveness	Long-Term Effectiveness	Permanence	Implementability	Compliance with ARARs	Community Acceptance	Cost
Drum Disposal Area (Zones 1a & 1b) and the Ridge Area	- No Action - Status Quo	No change in volume No change in toxicity No change in mobility	no reduction of risk	no reduction of risk	restrict accessibility	not applicable	no	no	-
	- Waste Characterization and Removal - Off-site Disposal	Volume increase No change in toxicity No change in mobility	risk may increase during removal	reduction of risk	no management required	difficulty in obtaining off-site permits	yes	good	$20,250,000
	- Waste Characterization and Removal - Temporary Storage, On-site Incineration, and On-site Disposal	Volume reduction Toxicity reduction Mobility reduction	risk may increase during removal	reduction of risk	no management required	technically feasible/ treatability studies needed	yes	marginal	$18,250,000
	- Waste Characterization and Removal - Temporary Storage, On-site Incineration, and On-site Disposal - Bioreclamation of Soils	Volume reduction Toxicity reduction Mobility reduction	risk may increase during removal	reduction of risk	no management required	difficult to treat mixed wastes	yes	marginal	$19,985,400
Inert Disposal Area	- No Action - Status Quo	No change in volume No change in toxicity No change in mobility	physical hazards still exist	physical hazards still exist	restrict accessibility	not applicable	no	no	-
	- Surface Debris Removal and Off-site Disposal - Capping	Volume reduction No change in toxicity Possible mobility reduction	risk may increase during removal	reduction of risk	periodic inspections required	proven technology	yes	good	$1,161,000

* Groundwater monitoring over all disposal areas is incorporated under the groundwater area of concern.

Table 8

Criteria for Selection of Remedy

3/24/88
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Area of Concern	Remedial Package	Reduction in Volume, Toxicity, and Mobility	Short-Term Effectiveness	Long-Term Effectiveness	Permanence	Implementability	Compliance with ARARs	Community Acceptance	Cost
Grantham South Area	- No Action - Status Quo	No change in volume No change in toxicity No change in mobility	no reduction of risk	no reduction of risk	restrict accessibility	not applicable	no	no	-
	- Capping	No change in volume No change in toxicity Possible mobility reduction	risk may increase during removal	reduction of risk	periodic inspections required	proven technology	yes	fair	$830,000
Groundwater	- No Action - Status Quo	No change in volume No change in toxicity No change in mobility	no reduction of risk	no reduction of risk	maintain recovery well system	historically proven on site	no	fair	$1,081,000
	- Status Quo - On-site Treatment - Monitoring	No change in volume Toxicity reduced No change in mobility	reduction of risk	reduction of risk	maintain recovery well system	proven technology	yes	good	$4,753,000
	- Ceasing Recovery Well Pumpage - Monitoring	Possible volume reduction No change in toxicity No change in mobility	direct contact risk increased	direct contact risk increased	monitor stream	not applicable	no	no	shut-down costs

VIII. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes to the preferred alternative presented in the proposed plan have occurred.

IX. SELECTED REMEDIAL ALTERNATIVE

According to 40 CFR Section 300.68(i) of the NCP, the appropriate extent of remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of human health and the environment. In addition, CERCLA requires selection of a remedy which provides protection to human health and the environment, which is cost-effective and utilizes permanent solutions and alternative treatment technologies or resource recovery options, to the maximum extent practicable and attains federal and state ARAR's to the greatest extent practicable. In addition, treatment of the principal threat at the site to reduce the mobility, toxicity and volume of the hazardous substance is preferred. The remedy selected for each disposal area and for groundwater plume management resulted in the Selected Remedial Alternative "Package" discussed below.

A. DESCRIPTION OF SELECTED REMEDIAL ALTERNATIVE PACKAGE AND PERFORMANCE GOALS

Drum Disposal and Ridge Area - Alternative 3. - Removal and On-Site Incineration - Waste characterization in both areas will occur to distinctly define areas before removal. Complete removal of contaminated wastes and soils will occur in both areas. In the Ridge Area removal will occur to approximately a 5 foot depth across the entire area. In the drum disposal area removal of soils will occur until the accept-

able soil concentrations listed in Table 7 are met. Upon completion of complete removal, the areas will be properly graded and revegetated.

Wastes and contaminated soils will then be treated on-site by incineration. The most appropriate type of incinerator to be used on-site will be determined via engineering evaluation and treatability studies during the remedial design. Residual ash, scrubber water etc. from the incineration operation will be analyzed and disposed of in accordance with all State and Federal Resource Conservation Recovery Act Subtitle C or D requirements.

The incinerator will operate as per Air Pollution Control Regulations, 40 CFR 60 CAA, as well as Resource Conservation and Recovery Act Part 264 Subpart O Regulations. It is estimated this portion of the remedial action package will take 3 to 5 years.

Inert Area

- Alternative 2. - Removal of Surface Debris and Capping. Before attempting to cap this area removal of all surface debris (i.e., trucks, buses, cars, etc.) must occur. The surface debris will be removed from the site in order to prevent physical injury and disturbance of any remedial action and operation and maintenance. Capping of this area will occur as per the Delaware Solid Waste Regulations (7 Delaware Code Chapter 60). The capping operation is estimated to be completed in one year.

Grantham South Area

- Alternative 2. - Capping - Capping of this area will comply with the RCRA requirements (40 CFR 264 RCRA Subtitle C) for permeability. An appropriate type of cap will be chosen in the remedial design

phase. The capping operation is estimated to be completed in four to six months.

Groundwater Plume

- Alternative 2. - Groundwater Pumping and Treatment of Discharge - Recovery of contaminated groundwater will occur with the 5 recovery well system - RW-13, Well 31, RW-12, Well 29, Well-29 - currently recovering DS&G contamination. Pumping will continue with quarterly inspections and maintenance of the recovery well system. Wells will be inspected and maintained to insure their continual functioning. Monitoring of at least 10 monitoring and/or recovery wells in the area of Delaware Sand and Gravel will be required quarterly in order to evaluate the continued effectiveness of the remedial action.

  Cessation of the recovery well system will occur sometime after source removal has occurred and the groundwater at the site boundary has consistently met the acceptable water exposure levels indicated in Table 7. Presently 10 years of recovery well operation is estimated.

  Recovered contaminated groundwater will be treated as per the National Pollution Discharge Elimination System regulations before being discharged into Army Creek.

Operation and Maintenance of the Selected Remedial Alternative

- Drum Disposal and Ridge Area - Maintenance of land surface in response to subsidence and/or erosion will be required.

- Inert Area and Grantham South Area - Maintenance of both caps will be required to ensure they are functioning properly.

- Groundwater/Surface Water - Sediments

Upon cessation of the groundwater recovery and treatment system (cessation of discharge to Army Creek) the pond and creek water levels and vegetation will be evaluated for 2 years. If a drastic reduction of water flow occurs and Phragmites becomes the dominant species, it is recommended the area be seeded with indigenous species. Also required will be 2 sediment sampling events in Army Creek: one after 5 years of initiation of remedial action and one a year after pumping and treatment has ceased. The sediment sampling will include sediment chemistry and sediment bioassays.

B. STATUTORY DETERMINATIONS

- Drum Disposal and Ridge Area - The selected alternative, Removal and Incineration for the Drum Disposal Area, was determined to be protective of human health and the environment, to have manageable short-term risks, to be cost effective, to attain all ARAR's and reduce the toxicity, mobility or volume of wastes.

Alternative 1 for the Drum Disposal and Ridge Areas - No Action - was determined to leave potential groundwater ingestion risk for a minimum of 30 years and also do nothing to reduce the direct contact risk to surface soils in the Ridge Area. Alternative 2 Removal and off-site disposal was found to reduce on-site risks; however, this alternative had the potential to produce long-term risks at an off-site facility. Alternative 4 Removal - On-Site Incineration and Bioreclamation of soils was determined to be over protective of human health and the environment.

- Consequently, Alternative 3 was determined to be the best alternative for

adequately protecting human health and the environment in the Drum Disposal and Ridge Areas of the site.

Each alternative evaluated for the Drum Disposal and Ridge Areas presented some degree of short-term risks. Removal and incineration pose short-term risks associated with removal, and incineration. These could be properly mitigated through proper health and safety programs and site access restriction. Also the long-term effectiveness (reduction of risk) of the selected alternative for the Drum Didsposal and Ridge Area for out weigh the manageable short-term risks.

The selected remedy affords overall effectiveness proportional to its costs. Of the four alternatives presented for the Drum Disposal and Ridge Area the one chosen is estimated to cost $18,250,000. This cost is less than the other 3 alternatives, and it provides the best overall effectiveness of the four alternatives.

The selected alternative for the Drum Disposal and Ridge Area is consistent with all applicable or relevant and appropriate State and Federal requirements listed below.

1. National Primary Drinking Water Standards pursuant to SDWA, 42 USC 300, and/or appropriate risk levels for potential exposure to contaminated groundwater.
2. Federal and State Pollution Discharge Elimination Standards pursuant to CWA, 40 CFR 122, for treatment and discharge of recovered groundwater.
3. Federal and State RCRA regulations pursuant to 40 CFR 264 RCRA

Subtitle C for closure of a hazardous waste landfill with waste in place.

4. State Solid Waste Regulations pursuant to 7 Delaware Code, Chapter 60, for closure of a Solid Waste landfill with waste in place.
5. Federal and State Ambient Air Quality Standards pursuant to 40 CFR 60 CAA for control of emissions during the operation of an on-site incinerator.
6. Federal and State RCRA regulations pursuant to Part 264 Subpart O of RCRA for design and operation requirements of hazardous waste incinerator.
7. Federal and State Coastal Zone Management requirements pursuant to Delaware Code Chapter 70 for operation of an incinerator within a coastal zone area.
8. Delaware River Basin Commission and State of Delaware Water Supply requirements for continued operation of the recovery well system.

Alternative 1 No Action attained none of the ARAR's, Alternative 2 attained some, but compliance with RCRA land disposal requirements would cause problems when implementing this alternative. Alternative 3 attained all ARAR's to a degree over and above those required for protection of human health and the environment.

The selected alternative for the Drum Disposal and Ridge Area also satisfies the statutory preference for remedies employing treatment that permanently and significantly reduces the toxicity, mobility or volume of hazardous substances. Incineration of wastes and soils from the Drum

. Disposal and Ridge Areas well permanently reduce the volume, toxicity and

mobility of waste and contaminated soil and also indirectly reduces the leaching of contaminants into the groundwater.

Alternatives 1 and 2 did not reduce to any degree the toxicity, mobility or volume of hazardous waste. Alternative 3 further reduced the toxicity, mobility and volume of wastes in soils, however this was determined to be over protective and not cost-effective.

- Inert Area - The selected alternative for the Inert Area was determined to be protective of human health and the environment, to eleiminate long-term risks, to be cost effective, and to atttain all ARAR's.

In the Inert Area Alternative 2 Surface Debris Removal and Capping elimates the physical contact risk associated with this area and therefore was determined to be protective of human health and the environment. Alternative 1 - No Action did not eliminate the present risk and therefore could not be considered protective.

Alternative 2 for the Inert Area in the short-term presents no risk and it also eliminated the physical injury risk as well as the continued potential for illegal dumping. Alternative 1 No Action eliminated no risks.

Alternative 2 for the Inert Area also is consistent with the applicable RCRA subtitle D or Delaware Solid Waste Regulations. Alternative 1 does not attain the above mentioned ARAR.

For the Inert Area the capping alternative was determined to be the best alternative when overall effectiveness and cost was considered. The

capping option was more expensive than the no action; however capping was less expensive than removal of wastes and off-site disposal.

- Grantham South - The selected alternative, Capping for the Grantham South Area, was determined to be protective of human health and the environment to mitigate short and long-term risks, to be cost effective, to attain all ARAR's and reduce the mobility of hazardous wastes.

  In the Grantham South Area Alternative 2 Capping was determined to eliminate any direct contact risk and also reduce potential migration of hazardous constituents into the groundwater. Alternative one did not reduce any risks and therefore was not protective of human health and the environment.

  In this area the capping alternative was determined to be the best alternative when overall effectiveness and cost was considered. The capping option was more expensive than the no action; however capping was less expensive than removal of wastes and disposal or treatment.

  In the Grantham South Area Alternative 2 Capping is consistent with the applicable RCRA Subtitle C closure requirements. Alternative 1 - No Action does not attain the above mentioned ARAR.

- Groundwater Plume Management - The selected Alternative 2 Pump and treat for the Groundwater Plume was determined to be protective of human health and the environment, to mitigate long-term risks, to be cost-effective, to attain all ARAR's and reduce the mobility toxicity and volume of hazardous substances in the groundwater.

In the Groundwater Plume Management Alternative 2, Pump and Treatment was determined to reduce the groundwater ingestion risk (in conjunction with source removal) in less than 10 years; therefore in the long run being protective of the human health. Also the alternative treats the discharge unlike alternative 1 (pumping with no treatment) making the selected remedy protective of the environment. Alternative 3 No Action was not protective of human health and the environment.

No short-term risks to on-site workers was determined for any of the groundwater plume management alternatives.

The selected groundwater alternative was determined to be the best alternative when overall effectiveness and cost was considered. The Alternative 2 was estimated at $4,753,000, well over the cost of Alternatives 1 and 3. However, Alternatives 1 and 3 were determined not to be protective of human health and the environment.

Alternative 2 for the groundwater plume management considers the relevant and appropriate requirements of SDWA (MCL's) and NPDES for discharge limits.

Alternative 1 would not attain NPDES standards or the SDWA requirements of MCL's.

The Groundwater Plume Management selected alternative will reduce the mobility toxicity and volume of contaminated grounwater by pumping and treating contaminated groundwater. Alternative 1 would reduce the volume but not the toxicity. Alternative 3 would reduce none.

THE SELECTED ALTERNATIVE

Drum Disposal and Ridge Area	- Removal On-Site Incineration	$18,250,000
Inert Disposal Area	- Capping	1,161,000
Grantham South	- Capping	830,000
Groundwater Plume	- Pump and Treat	4,753,000
		$24,994,000

The selected alternative meets the goals and objectives for remediation of this site.

NC5Q07

APPENDIX A

SUMMARY OF ANALYTICAL DATA

Table 5.11
Inorganic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Surface Soil Sampling
(milligrams per kilogram)

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Sample Site	Percent Moisture	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	Sn	V	Zn
B-01	10.0	3070	(16	(3.6	23.0	0.82	(2.8	479	15.0	(3.9	23 J	8300	50 J	221	141 J	(0.056	13.0	(301	(2.8	(1.7	(343	(5.6	(8.9	11.0	30 J
B-01d	24.0	4070	(17	(4.4	8.8	(0.44	(3.3	(333	6.9	210	24	2440	8.6 J	(194	43	0.130	8.3	(337	(3.3	(2.0	(430	(4.4	(11.0	3.9	43.0
B-01s	24.0	11200	(17	(4.4	9.1	(0.44	(3.3	(333	11.0	214	48	4440	12	(194	30	0.160	9.7	(337	(3.3	(2.0	(430	(4.4	(11.0	(3.3	45.0
B-02	16.0	11200	(13	(3.8	26.0	(0.38	(2.8	1730	27.0	30	74	27100	10	974	317	0.071	20.0	703	(30.0	(1.8	1307	(4.0	(9.3	3.1	122.0
B-02d	18.0	12500	(14	4.1	68.0	0.68	(3.0	1980	44.0	430	50	27000	66	2970	157	1.700	28.0	1180	(3.0	(1.8	(398	(4.1	(9.8	20.0	170
B-02s	22.0	12500	(17	(4.4	68.0	(0.44	(3.3	377	130.0	82 J	364 J	23400	100 J	2260	619 J	0.910	22.0	643	(3.3	(1.9	(419	(4.4	14 J	61.0	184 J
B-03	20.0	2260	(16	(4.1	12.0	0.66	(3.1	270	30.0	243 J	133 J	21900	55 J	923	172 J	0.650	8.0	458	(3.1	2.1	(408	(4.1	(10.0	14.0	57 J
B-03d	16.0	447	(15	(3.8	24.0	(0.38	(2.9	233	20.0	251 J	73 J	21700	14 J	(172	118 J	(0.058	5.4	(315	(2.9	1.8	(380	(3.8	(9.3	3.1	11 J
B-03s	26.0	777	(20	(5.0	12.0	(0.50	(3.9	(375	11.0	260 J	319 J	2950	70 J	(230	9.6 J	0.190	7.1	(423	(3.9	(2.3	(510	(5.0	(12.0	(3.9	9.1 J
B-04	14.0	447	(15	(3.8	24.0	(0.38	(2.9	233	20.0	251 J	73 J	21700	14 J	(172	118 J	(0.058	5.4	(315	(2.9	1.8	(380	(3.8	(9.3	3.1	11 J
B-04d	26.0	777	(20	(5.0	12.0	(0.50	(3.9	(375	11.0	260 J	319 J	2950	70 J	(230	9.6 J	0.190	7.1	(423	(3.9	(2.3	(510	(5.0	(12.0	(3.9	9.1 J
B-04s	26.0	17200	(18	11.0	62.0	1.20	(3.4	1280	45.0	37 J	31 J	24300	19 J	2940	230 J	(0.068	24.0	1010	(3.4	(2.0	(491	(4.8	(11.0	36.0	117 J
B-05	6.0	1790	(14	(3.2	8.0	(0.32	(2.7	1150	24.0	57 J	55 J	12000	54	1260	702 J	1.200	13.0	649	(2.7	(1.6	665 J	(3.2	(8.3	17.0	117 J
B-05d	14.0	11900	(15	(4.0	52.0	1.00	(3.6	749	34.0	5.6 J	10 J	22400	9.5 J	2210	167 J	(0.060	9.6	388	(3.6	2.1	477 J	(4.0	(9.3	23.0	38 J
B-05s	16.0	9720	(15	(4.0	36.0	1.30	(3.6	444	27.0	8.2 J	9.6 J	18500	14 J	945	283 J	(0.060	6.3	411	(3.6	2.7	478 J	(4.0	(9.3	32.0	73 J
B-07	12.0	353	(13	(3.2	40.0	(0.32	(2.8	(280	7.2	(4.8	13 J	2020	12 J	(140	46 J	0.200	(3.6	(368	(2.8	(1.7	(371	(3.2	(8.1	(2.8	6.0 J
B-07s	6.0	1400	(14	(3.3	30.0	1.00	(2.7	414	33.0	15 J	44 J	28000	31 J	211	1190 J	1.020	12.0	604	(2.7	1.6	560 J	(3.3	(8.5	6.9	23 J
B-08	16.0	2410	(15	(3.8	18.0	(0.38	(2.9	309	6.0	(4.1	5.1	3850	5.7 J	182	130	(0.058	3.9	(315	(2.9	(1.7	(380	(3.8	(9.3	17.0	31.0
B-08s	18.0	6200	(16	(4.1	40.0	(0.41	(3.0	1710	11.0	6.3	9.5	13600	110	545	242	(0.061	10.0	377	(3.0	(1.8	(398	(4.1	(9.8	30.0	90.0
B-09	12.0	8200	(15	(3.7	46.0	(0.36	(2.9	(267	11.0	12	7.0	12300	7.1 J	499	448	(0.059	7.0	319	(2.9	(1.8	(304	(3.9	(9.4	20.0	71.0
B-09s	14.0	3520	(15	(3.7	24.0	(0.37	(2.9	(267	6.7	(4.0	6.7	8040	11 J	212	141	(0.057	5.0	(312	(2.9	(1.7	(373	(3.7	(9.2	19.0	17.0
B-10	20.0	4800	(16	(4.3	33.0	(0.43	(3.1	233	8.5	6.4	7.6	8590	8.1 J	331	136	(0.063	4.9	(330	(3.1	(1.9	(408	(4.3	(10.0	22.0	16.0
B-10s	24.0	9380	(17	(4.7	42.0	1.00	(3.3	343	11.0	10	8.9	18700	25	631	277	(0.063	11.0	436	(3.3	(2.0	(438	(4.3	(11.0	28.0	34.0
B-11	20.0	10500	(16	(4.1	32.0	1.00	(3.1	253	14.0	8.4	11	16900	7.3 J	543	273	(0.063	7.8	384	(3.1	(1.9	(408	(4.1	(10.0	24.0	55.0
B-11s	18.0	8400	(16	(4.1	31.0	(0.41	(3.0	226	9.7	6.3	7.3	11100	7.3 J	257	196	(0.061	6.8	(326	(3.0	(1.8	(398	(4.1	(9.8	24.0	18.0
B-12	22.0	11200	(17	(4.4	43.0	1.30	(3.3	334	16.0	9.4	8.6	22900	9.6 J	689	461	(0.064	10.0	602	(3.3	(1.9	(419	(4.4	(10.0	45.0	29.0
B-12s	18.0	7110	(16	(4.1	34.0	(0.41	(3.0	364	11.0	6.3	8.0	14200	11 J	447	305	(0.061	7.3	349	(3.0	(1.8	(398	(4.1	(9.8	29.0	23.0
B-13	10.0	4630	(14	(3.4	47.0	(0.34	(2.8	(196	6.4	(3.9	7.5	9790	9.4 J	265	132	(0.056	6.7	(301	(2.8	(1.7	(343	(3.4	(8.9	16.0	14.0
B-13 d	NA	10200	80	14.0	8020.0	0.83	21.0	10300	222.0	23 J	393 J	123000	6750	1030	1540 J	(0.062	158.0	774	(3.1	3.7	885 J	(4.3	116 J	44.0	4380 J
B-13 s	20.0	9970	172	97.0	6450.0	0.79	26.0	21100	158.0	8.1	2200	64000	3400	1550	304	0.075	125.0	569	(3.1	(1.9	1140	(4.3	227	93.0	9160
B-14	12.0	24200	(18	27.0	185.0	0.98	(3.1	2360	24.0	8.9	219	22800	620	820	392	(0.062	19.0	1210	(3.1	(1.9	(403	(4.3	19.0	52.0	349
B-14d	20.0	10800	(18	(4.4	58.0	0.97	(3.3	976	14.0	7.1	9.5	12900	17 J	573	237	(0.069	13.0	638	(3.3	(2.1	(453	(4.4	(11.0	40.0	50.0
B-14s	22.0	6360	(19	(4.7	25.0	(0.74	(3.7	1090	13.0	7.1	11	13600	9.5 J	1220	288	(0.074	12.0	1390	(3.7	(2.3	(488	(4.7	(11.0	33.0	41.0
B-15	24.0	10700	(19	(4.7	53.0	1.00	(3.6	343	19.0	11	11	23000	29 J	780	388	(0.073	11.0	881	(3.6	(2.2	(472	(4.7	(11.0	52.0	58.0
B-16	18.0	13200	(16	(4.1	44.0	1.00	(3.2	343	17.0	9.1	7.9	19300	9.8 J	672	260	(0.063	11.0	570	(3.2	(2.0	(398	(4.1	(9.8	43.0	38.0
B-17	20.0	13700	(16	(4.1	48.0	1.00	(3.1	383	17.0	10	11	22100	10 J	743	251	(0.063	12.0	598	(3.1	(1.9	(403	(4.1	(10.0	43.0	54.0
B-18	20.0	10400	(16	(4.1	41.0	1.00	(3.1	(329	17.0	9.1	10	27400	8.1 J	683	222	(0.063	14.0	672	(3.1	2.3	(408	(4.1	(10.0	38.0	52.0
B-19	12.0	1180	(13	(3.4	12.0	(0.34	(2.9	1190	(2.9	(4.1	4.0	10600	10 J	440	233	(0.057	(3.1	312	(2.9	(1.7	(373	(3.4	(9.2	(2.9	20.0
B-19d	14.0	3220	(15	(3.8	20.0	(0.38	(2.9	1460	6.0	(4.0	4.0	8880	12 J	362	264	(0.058	(3.2	315	(2.9	(1.7	(388	(3.8	(9.3	(2.9	19.0
B-19s	12.0	3220	(15	(3.8	20.0	(0.38	(2.9	(288	11.0	(4.0	21	17000	12 J	1220	115	(0.057	(3.2	(308	(29.0	(1.7	(371	(3.8	(9.3	(2.9	24.0
B-20	30.0	345	230	(22.0	120.0	(0.57	(4.1	1300	81.0	8.4	17100	117000	175	(322	345	1.300	15.0	870	(4.1	(2.5	1490 J	(4.6	(13.0	(4.1	(11.4
B-21	12.0	9970	(16	(4.0	41.0	0.93	(3.0	(337	14.0	8.7	8.2	14900	6.6 J	573	289	0.072	10.0	387	(3.0	1.8	(393	(4.0	(9.6	32.0	23.0
B-21d	14.0	14400	(18	(4.7	58.0	1.00	(3.1	341	18.0	8.9	9.8	22000	9.8 J	719	381	(0.063	12.0	224	(3.1	(1.9	(403	(4.7	(9.9	47.0	31.0
B-21s	20.0	14400	(18	6.2	58.0	1.00	(3.1	341	19.0	9.4	23	24300	18 J	663	412	(0.063	13.0	488	(3.1	(1.9	(408	(4.3	(10.0	35.0	32.0

s,d 's' suffix implies 0-1' sampling interval; 'd' suffix implies 2-3' sampling interval; no designation implies single sample at location from 0-1'
D Duplicate analyses
J Estimated quantity because quality control criteria were not met
NA Sample not analyzed for this parameter.

Table 5.12

Organic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Surface Soil Sampling
(micrograms per kilograms)

Sample Site	Percent Moisture	Methylene Chloride	Acetone	2-butanone (MEK)	tri-chloro-ethene	4-methyl-2-pentanone (MIBK)	2-hexanone	tetra-chloro-ethene	Toluene	Ethyl Benzene	Total Xylenes	Naphthalene	di-benzo-furan	phen-anthrene	di-n-butyl phthalate
B-01	0	2 BJ	(10	(10	(5	(10	(10	(5	(5	(5	(5	(3700	(3700	(3700	(3700
B-01A	22	(7	(15	(15	250	63	(15	66	120	(7	90	(29000	(29000	(29000	(29000
B-01B	22		(15	(15	5 J	(13	(13	(6	3 BJ	(6	(6	(25000	(25000	(25000	(25000
B-02A	22		(15	(15	(6	(13	(13	(6	56	(6	(6	(25000	(25000	(25000	(25000
B-02B	4		(15	(15	23 JB	(11	(11	(5	20	(5	11	(21000	(21000	(21000	(21000
B-03A	17		(12	(12	(6	(12	(12	(6	1 BJ	(6	(6	(24000	(24000	(24000	(24000
B-03B	27		(13	(13	(6	(13	(13	(6	1 BJ	(6	4 J	(26000	(26000	(26000	(26000
B-04A	23		(11	(11	(6	(11	(11	(6	1 BJ	(6	3	(23000	(23000	(23000	(23000
B-04B	28		(14	(14	(7	(14	(14	(7	1 BJ	(7	13	(140000	(140000	(140000	(140000
B-05A	18		(14	(14	(7	(14	(14	(7	(7	(7	(7	(660	(660	93	(660
B-05B	11		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-06A	14		(11	(11	(6	(11	(11	(6	(6	(6	(6	(390	(390	(390	(390
B-06B	16		(11	(11	(6	(11	(11	(6	(6	(6	(6	(410	(410	(410	(410
B-07A	3.21		(11	(11	(5	(11	(11	(5	(5	(5	(5	(410	(410	(410	(410
B-07B	16		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-08A	6		(11	(11	(5	(11	(11	(5	(5	(5	(5	(350	(350	(350	(350
B-08B	15		9 BJ	(12	(6	(12	(12	(6	(6	(6	(6	(390	(390	(390	(390
B-08C	15		9 BJ	(12	(6	(12	(12	(6	(6	(6	(6	(390	(390	(390	240 J
B-09A	18		(11	(11	(6	(12	(12	(6	(6	(6	(6	(410	(410	(410	(410
B-09B	16		(11	(11	(6	(12	(12	(6	(6	(6	(6	(400	(400	(400	(400
B-09C	23		(11	(11	(6	(11	(11	(6	(6	(6	(6	(390	(390	(390	(390
B-09D	23		(11	(11	(6	(11	(11	(6	1 BJ	(6	(6	(430	(430	(430	(430
B-10A	21		(11	(11	1 BJ	(11	(11	(6	(6	(6	(6	(420	(420	(420	(420
B-10B	23		(11	(11	1 BJ	(11	(11	(6	(6	(6	(6	(440	(440	(440	(440
B-10C	21		(11	(11	1 BJ	(11	(11	(6	(6	(6	(6	(380	(380	(380	(380
B-10D	21		(11	(11	(6	(11	(11	(6	(6	(6	(6	(420	(420	(420	(420
B-11A	16		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-11B	16		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	74 J	160
B-11C	4		(11	(11	(5	(11	(11	(5	(5	(5	(5	110 J	(370	62 JB	(370
B-11D	16		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-12A	38		(16	(16	(8	(16	(16	(8	(8	(8	(8	(540	(540	(540	(540
B-12B	39		(15	1 J	(8	(16	(16	(8	(8	(8	(8	(520	(520	(520	(520
B-13A	25		(13	(13	(7	63	90	(7	(7	1 J	(7	(470	(470	(470	(470
B-13B	20		(11	(11	(6	(12	(12	(6	1 BJ	(6	(6	(410	(410	(410	(410
B-14A	22		(11	(11	(6	(13	(13	(7	1 BJ	(7	(7	(440	(440	(440	(440
B-14B	21		(12	4 J	(6	(13	(13	(6	1 BJ	(6	(6	(420	(420	(420	(420
B-15A	18		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	300 J
B-15B	18		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	410
B-16A	15		(11	(11	(6	(12	(12	(6	(6	(6	(6	(400	(400	(400	(400
B-16B	9		(11	(11	(5	(11	(11	(5	(5	(5	(5	(18000	14000	(18000	(18000
B-15	18		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-16	18		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370
B-17	18		(11	(11	(6	(11	(11	(6	(6	(6	(6	(370	(370	(370	(370

A,B 'A' suffix implies 0-1' sampling interval; 'B' suffix implies 2-3' sampling interval; no designation implies single sample at location from 0-1'.
D Duplicate analyses
J Estimated quantity because quality control criteria were not met
B Tentative identification
BJ A compound was detected but not in high enough concentrations to confirm its presence.

Table 5.12 (cont'd)

Organic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Surface Soil Sampling
(micrograms per kilogram)

Sample No.	Fluoranthene	Pyrene	Butylbenzylphthalate	bis (2-ethylhexyl) phthalate	beta-BHC	gamma-BHC	Heptachlor epoxide	Methoxychlor	PCB-1254	PCB-1260	Phenol	Benzo(a) pyrene	dichlorobenzene (meta)	1,1,1-trichloroethane
B-01	<3700	<3700	<3700	<3700	<190	<190	<190	<1900	<3700	<3700	<3700	<3700	NA	<5
B-01d	<29000	<29000	<29000	17400 J	<250	<250	480 B	<2500	<4900	<4900	<29000	<29000	122 J	<7
B-01s	<25000	<25000	<25000	12500 J	<42	130 B	140 B	<420	<830	<850	<25000	<25000	NA	5 JB
B-02d	<26000	<26000	<26000	<26000	<850	<850	<850	<8500	<17000	<17000	<26000	<26000	NA	<4
B-02s	<21000	<21000	<21000	<21000	<100	34 B	<100	<1000	<2100	<2100	<21000	<21000	43 J	<5
B-03d	<24000	<24000	<24000	87000	<78	<78	<78	<780	7600	<1600	<24000	<24000	NA	<6
B-03s	<26000	<26000	<26000	<26000	<210	<210	<210	<2100	<4100	<4100	<26000	<26000	NA	<6
B-04d	<23000	<23000	<23000	<23000	<190	<190	<190	<1900	<3700	<3700	<23000	<23000	NA	<6
B-04s	<160000	<160000	<160000	<160000	<140	<140	<140	<1400	<2800	<2800	<160000	<160000	NA	<7
B-05d	<460	44	<460	<460	<230	<230	<230	<2300	<4700	<4700	<460	<460	NA	<7
B-05s	<370	<370	<370	300	<37	<37	<37	<370	<750	<750	<370	<370	NA	<6
B-06d	<390	<390	<390	<390	<3.9	<3.9	<3.9	<39	<78	<78	<390	<390	NA	<6
B-06s	<410	<410	<410	<410	<4.1	<4.1	<4.1	<41	<81	<81	<410	<410	NA	<5
B-07d	<370	<370	<370	<370	<37	<37	<37	<370	<740	<740	<370	<370	NA	<6
B-07s	<350	<350	<350	<350	<18	<18	<15	<180	<350	<350	<350	<350	NA	<5
B-08d	<390	<390	<390	<390	<3.9	<3.9	<3.9	<39	<78	<78	<390	<390	NA	<6
B-08s	<390	<390	<390	<390	<3.9	<3.9	<3.9	<39	<78	210	<390	<390	NA	<6
B-09d	<410	<410	<410	<410	<4.1	<4.1	<4.1	<41	<81	<81	<410	<410	NA	<6
B-09s	<400	<400	<400	<400	<4.0	<4.0	<4.0	<40	<79	<79	<400	<400	NA	<6
B-10d	<446	<446	<446	<446	<4.4	<4.4	<4.4	<44	<89	<89	<446	<446	NA	<7
B-10s	<430	<430	<430	<430	<4.3	<4.3	<4.3	<43	<87	<87	<430	<430	NA	<6
B-11d	<420	<420	<420	<420	<4.2	<4.2	<4.2	<42	<84	<84	<420	<420	NA	<6
B-11s	<446	<446	<446	<446	<4.4	<4.4	<4.4	<44	<89	<89	<446	<446	NA	<7
B-12d	<380	<380	<380	<380	<3.8	<3.8	<3.8	<38	<76	<76	<380	<380	NA	<6
B-12s	<420	<420	<420	<420	<4.2	<4.2	<4.2	<42	<84	<84	<420	<420	NA	<6
B-06	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	<370	<370	NA	<6
B-07 s1	110 J	37 J	1400	330 J	<37	<37	<37	<370	1500	<740	30 JB	44 J	NA	<6
B-07 s2	<370	<370	<370	180	<3.7	<3.7	<3.7	<37	220 J	<73	30 JB	<370	NA	<5
B-08	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	<370	<370	NA	<6
B-09d s1	<540	<540	<540	<540	<5.4	3.9 B	<5.4	<54	190	<110	<540	<540	NA	<8
B-09d s2	<520	<520	<520	<520	<5.2	2.7 B	<5.2	<52	150	<100	<520	<520	13 JB	<8
B-09s	<470	<470	<470	<470	<4.7	5.1 B	<4.7	<47	<94	<94	<470	<470	NA	<7
B-10	<410	<410	<410	<410	8 B	7.7 B	<4.1	<41	<81	<81	<410	<410	NA	<6
B-11	<440	<440	<440	<440	42 B	7.7 B	<4.4	<44	<88	<88	<440	<440	NA	<7
B-12	<420	<420	<420	<420	<4.2	<4.2	<4.2	<42	97	<84	<420	<420	NA	<6
B-13d	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	160 JB	<370	NA	<6
B-13s	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	160 JB	<370	NA	<6
B-14d	<440	<440	<440	<440	<4.4	<4.4	<4.4	<44	<79	<79	<440	<440	NA	<6
B-14s	<18000	<18000	<18000	<18000	<720	<720	<720	<7200	99000	<14000	<18000	<18000	NA	2 JB
B-15	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	<370	<370	NA	<6
B-16	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	<370	<370	NA	<6
B-17	<370	<370	<370	<370	<3.7	<3.7	<3.7	<37	<74	<74	<370	<370	NA	<6

s,d 's' suffix implies 0-1' sampling interval; 'd' suffix implies 2-3' sampling interval; no designation implies single sample at location from 0-1'.
D Duplicate analyses
J Estimated quantity because quality control criteria were not met
B Tentative identification
R Quality Control criteria indicates that data are unusable. (Compound may or may not be present.)
NA Sample not analyzed for this compound.

Table 5.14
Inorganic Analytical Results of February/March, 1985
Delaware Sand and Gravel Landfill RI/FS Soil Boring Sampling
(in micrograms per gram unless otherwise noted)

Well	San. #	Depth (ft.)	Zone Sampled	Percent Moisture	Fe	Mn	Cr	Ag	Zn	Pb	Cd	Hg	As	Se	Ba	Ni	Cu	Co	Be	V	Sb	Tl	Co	Sn	Al	Mg
DGC-1d	S5e	20-22	C	16.2	16,522	67.12	<10	<10	19.89	51.71	<10	<0.4	<3	<0.5	27.35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S5e	20-22	C	15.5	18,308	92.21	<10	<10	25.64	24.65	<10	<0.4	<3	<0.5	28.60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S20	90-92	uUP	19.5	3,072	38.22	<10	<10	13.38	<10.00	<10	<0.4	<3	<0.5	12.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S31	150-152	lUP	19.7	2,068	31.13	<10	<10	10.54	<10.00	<10	<0.4	<3	<0.5	11.49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-2d	S12	55-57	uUP	23.3	2,477	28.04	<10	<10	<10.00	<10.00	<10	<0.4	<3	<0.5	16.02	11.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S14	65-67	uUP	15.1	2,402	46.13	<10	<10	<10.00	<10.00	<10	<0.4	<3	<0.5	11.78	12.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S25e	120-122	lUP	16.1	167	10.92	<10	<10	<10.00	<10.00	<10	<0.4	<3	<0.5	<10.00	11.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S25e	120-122	lUP	16.2	202	15.91	<10	<10	<10.00	<10.00	<10	<0.4	<3	<0.5	<10.00	11.93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-3d	S11e	50-52	UPcc	16.6	1,824	14.99	<10	<10	10.99	<10.00	<10	<0.4	<3	<0.5	14.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S11e	50-52	UPcc	17.6	4,415	18.20	<10	<10	15.17	<10.00	<10	<0.4	<3	<0.5	10.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S13	60-62	uUP	21.7	3,056	10.81	<10	<10	<10.00	23.08	<10	<0.4	<3	<0.5	15.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S22	105-107	lUP	17.5	1,778	<10.00	<10	<10	<10.00	<10.00	<10	<0.4	<3	<0.5	<10.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

e Duplicate analyses
NA Sample not analyzed for this parameter.
C Columbia Formation
UPcc Upper Potomac confining clay
uUP upper Upper Potomac Hydrologic Zone
lUP lower Upper Potomac Hydrologic Zone

Table 5.16

Organic Analytical Results of February/March 1986
Delaware Sand and Gravel Landfill RI/FS Soil Boring Sampling
(micrograms per kilogram)

Well Number	Sample Number	Depth (ft)	Zone Sampled	Percent Moisture (%)	Toluene	Methylene Chloride	Acetone	2-butanone (MEK)	4-methyl-2-pentanone (MIBK)	Ethyl Benzene	Total Xylene	1,2-dichloro ethane	Chloroform	1,1,1-trichloro ethane	Phenol	bis-(2-chloro ethyl) ether	2-methyl phenol	4-methyl phenol	di-n-butyl phthalate	bis (2-ethyl hexyl) phthalate	Napthalene	benzoic acid	benzo anthracene
[illegible]	S-1	0-2	C	31.0	<7.0	7.0 BJ	<14	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-2	2-4	C	33.7	<8.0	8.0 BJ	16 BJ	<15	<15	<8.0	<8.0	<8.0	<8.0	<8.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-3	4-6	C	[illegible]	<7.0	7.0 BJ	<14	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-4	6-8	C	[illegible]	<7.0	7.0 BJ	22 BJ	<13	<13	<7.0	<7.0	<7.0	<7.0	<7.0	<620	<620	<620	<620	930 BJ	<620	<620	<3000	<620
[illegible]	S-5	8-10	C	31.0	<7.0	23 BJ	<14	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-6	10-12	C	[illegible]	<7.0	[illegible]	24 BJ	<15	<15	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-7	12-14	C	[illegible]	<7.0	[illegible]	<14	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	<500	<500	<500	<500	1100 BJ	<500	<500	<2000	<500
[illegible]	S-8	14-16	C	[illegible]	<7.0	[illegible]	<15	<15	<15	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-9	16-18	C	[illegible]	<7.0	[illegible]	14 BJ	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-10	18-20	C	[illegible]	<5.0	[illegible]	<11	<11	<11	<5.0	<5.0	<5.0	<5.0	<5.0	<440	<440	<440	<440	810 BJ	<440	<440	<2200	<440
[illegible]	S-11	20-22	C	[illegible]	<5.0	[illegible]	13 BJ	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
[illegible]	S-12	[illegible]	C	[illegible]	<6.0	[illegible]	<12	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<400	<400	<400	<400	[illegible] BJ	400 BJ	<400	<2000	<400
[illegible]	S-13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	<110	<110	150	1100	<59	<59	<59	<24000	<24000	<24000	<24000	24000 BJ	24400 BJ	6290 J	<116000	<24000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

- * [illegible] to analyses
- NA Sample not analyzed for this compound.
- P Tentative identification
- BJ A compound was detected but not in high enough concentrations to confirm its presence.

- C Columbia Formation
- UPcc Upper Potomac confining clay
- uHP upper Upper Potomac Hydrologic Zone
- UPdc Upper Potomac dividing clay

Table 5.15
Inorganic Analytical Results of February/March, 1986
Delaware Sand and Gravel Landfill RI/FS Soil Boring Sampling
(milligrams per kilogram)

Well #	Sample #	Depth (ft)	Zone Sampled	Percent Moisture	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	Sn	V	Zn
[illegible]	[illegible]	[illegible]	[illegible]	33.5	48700	(38)	8.8	166	2.6	(3.0	720	34.0	22	(13)	44900	6.8	1260	984	(0.14	24	476	(3.0	(3.3	2030	(4.3	28	104	62
[illegible]	[illegible]	[illegible]	[illegible]	40.1	33400	(32)	10.0	116	(2.5	(3.3	868	30.0	21	(13)	53900	10.0	1410	1660	(0.16	28	332	(3.3	(3.8	12720	(3.8	133	21	39
[illegible]	[illegible]	[illegible]	[illegible]	14.4	7430	(29	(4.7	(39	(1.8	(2.3	(350	15.0	(12	(9.4	20100	4.1	289	88	(0.11	(12	(293	(3.3	(4.1	(1500	(3.5	16	23	(10
[illegible]	[illegible]	[illegible]	[illegible]	10.7	3340	(28	(4.5	(37	(1.7	(2.2	(333	6.0	(11	(8.9	11900	4.7	188	33	(0.11	(11	(279	(3.1	(3.9	(1510	(3.3	15	(11	(9.5
[illegible]	[illegible]	[illegible]	[illegible]	13.2	5320	(29	(4.6	(39	(1.7	(2.3	(346	7.1	(12	(9.2	14700	2.9 J	433	130	(0.11	(12	(289	(3.3	(4.0	(1560	(3.5	16	(11	10
[illegible]	[illegible]	[illegible]	[illegible]	10.8	1040	(31	(4.9	(41	(1.8	(2.5	500	6.6	(12	9.9	2270	0.9 J	247	6.7	(0.12	(12	310	(3.5	(4.3	(1640	(3.7	(12	10	(10
[illegible]	[illegible]	[illegible]	UPcc	10.8	2120	(29	(4.7	(39	2.3	(2.3	691	69.0	(12	39	11800	7.0 J	240	42	(0.11	13	369	(3.3	(4.1	(1580	(3.5	16	42	18
[illegible]	[illegible]	[illegible]	UPcc	13.4	1380	(30	(4.7	(40	(1.8	(2.4	762	20.0	(12	28	3910	7.1 J	237	17	(0.11	(12	390	(3.4	(4.1	(1660	(3.5	(16	37	(10
[illegible]	[illegible]	[illegible]	[illegible]	10.3	5670	(28	(4.7	(39	(1.7	(2.3	(340	6.3	(12	(9.3	20400	2.9	181	121 J	(0.11	(12	(291	(3.3	(4.1	(1570	(3.5	(16	(12	(10
[illegible]	[illegible]	[illegible]	[illegible]	12.7	7260	(29	(4.6	(38	(1.7	(2.3	(341	9.0	(11	(9.1	27900	2.7	(134	38 J	(0.11	(11	(283	(3.3	(4.0	(1560	(3.4	(15	(11	(9.7
[illegible]	[illegible]	[illegible]	[illegible]	13.2	7260	(29	(4.6	(38	(1.7	(2.3	(343	6.2	(11	(9.1	23300	2.7	(134	83 J	(0.11	(11	(283	(3.3	(4.0	(1550	(3.5	(15	(11	(9.7
[illegible]	[illegible]	[illegible]	[illegible]	13.2	2210	(29	(4.6	(38	(1.7	(2.3	(347	(4.6	(11	(9.1	8680	2.1	169	68 J	(0.11	(11	(290	(3.3	(4.1	(1570	(3.5	(16	22	(9.9
[illegible]	[illegible]	[illegible]	UPcc	15.3	890	(29	(4.7	(40	(1.8	(2.4	(353	8.6	(12	16	4960	2.4	(140	24 J	(0.11	(12	(293	(3.4	(4.1	(1590	(3.5	(16	32	(10
[illegible]	[illegible]	[illegible]	[illegible]	14.1	11600	(30	8.9	99	(1.8	(2.4	(356	18.0	(12	(9.5	18000	8.9	677	171 J	(0.11	(12	(298	(3.4	(4.2	(1610	(3.6	(16	38	26
[illegible]	[illegible]	[illegible]	[illegible]	15.1	5670	(29	5.7	(40	(1.8	(2.4	(353	14.0	(12	(9.4	10400	4.7	144	47 J	(0.11	(12	(293	(3.4	(4.1	(1570	(3.5	(16	18	10
[illegible]	[illegible]	[illegible]	[illegible]	14.7	9990	(29	(4.7	(39	(1.8	(2.3	(351	27.0	(12	(9.4	22400	3.9	322	241 J	(0.11	(12	(293	(3.4	(4.1	(1580	(3.5	(16	32	17
[illegible]	[illegible]	[illegible]	[illegible]	17.6	7720	(30	(4.9	(43	(1.8	(2.4	(344	16.0	(12	(9.7	24900	4.7	620	248 J	(0.12	(13	(302	(3.5	(4.3	(1640	(3.6	(16	23	(11
[illegible]	[illegible]	[illegible]	C/UPcc	11.1	1530	(28	(4.3	(36	(1.7	(2.3	393	9.3	(11	11	9730	2.9	177	41 J	(0.11	(11	(283	(3.3	(3.9	(1520	(3.4	(15	(11	(9.4
[illegible]	[illegible]	[illegible]	uSP	10.3	353	(31	(5.0	(42	(1.9	(2.5	(371	(5.0	(12	(10	2530	1.9	(148	129 J	(0.12	(12	(311	(3.5	(4.3	(1680	(3.7	(17	(13	(11
[illegible]	[illegible]	[illegible]	uSP	10.3	1090	(31	(5.0	(42	(1.9	(2.5	(371	12.0	(12	11	69900	1.9	(147	892 J	(0.12	(12	(310	(3.5	(4.3	(1670	(3.7	(17	(13	17
[illegible]	[illegible]	[illegible]	[illegible]	23.4	36100	(37	12.0	158	(2.1	(3.0	345	44.0	(15	(13	23000	12.0	1050	332	(0.14	24	462	(3.8	(5.2	(2000	(4.3	(20	86	63
[illegible]	[illegible]	[illegible]	[illegible]	17.4	5180	(29	(4.8	(41	(1.7	(2.3	(346	(4.6	(12	(9.2	12400	3.3	240	78 J	(0.11	(12	(288	(3.3	(4.0	(1560	(3.5	(16	(17	11
[illegible]	[illegible]	[illegible]	[illegible]	17.7	6430	(30	(4.9	(41	(1.8	(2.4	(343	11.0	(12	(9.7	32100	3.6	291	222 J	(0.12	(13	(305	(3.4	(4.3	(1640	(3.6	(16	(18	22
[illegible]	[illegible]	[illegible]	[illegible]	30.2	663	(34	(5.8	(48	(2.2	(2.9	(430	(5.8	(14	(11	2030	2.9	(171	24 J	(0.14	(14	(340	(3.9	(5.0	(1940	(4.1	(19	(22	(12
[illegible]	[illegible]	[illegible]	[illegible]	19.3	334	(31	(5.0	(42	(1.9	(2.5	(371	(1.9	(12	(5.9	816	(1.2	(148	12 J	(0.12	(12	(310	(3.5	(4.3	(1680	(3.7	(17	(19	(11
[illegible]	[illegible]	[illegible]	[illegible]	17.1	32100 J	(16	(16.0	137	(2.0	12.0	305	37.0	24	12	47300 J	19.0	1270	445 J	(0.02	28	783	(30	(1.0	184	(2.4	49	77	94 J
[illegible]	[illegible]	[illegible]	[illegible]	16.1	48660 J	(16	(15.0	135	(2.7	13.0	362	30.0	26	11	47500 J	16.0	1500	742 J	0.7 J	28	858	(19	(1.0	167	(2.3	67	74	58 J
[illegible]	[illegible]	[illegible]	[illegible]	14.4	12900 J	(13	(13.2	39	(2.1	(3.0	91	(1.5	(0.4	4	5100 J	(1.4	181	278 J	0.1 J	(3.4	283	(3.2	(0.8	179	(1.8	(18	8.4	9 J
[illegible]	[illegible]	[illegible]	[illegible]	16.1	5160 J	(13	(13.2	23	(2.0	4.6	147	(1.5	(0.4	(4.9	88570 J	(1.5	333	124 J	0.1 J	(3.4	124	(3.2	(0.8	154	(1.7	(17	11	8.4 J
[illegible]	[illegible]	[illegible]	UPcc	17.2	639 J	(12	(13.1	14	(2.1	(3.0	100	(1.7	(0.5	(3.2	310 J	(1.6	61 BJ	1.4 J	0.1 J	9.7 J	135	(2.7	(0.8	115 BJ	(1.8	(18	(3.9	(3.2
[illegible]	[illegible]	[illegible]	[illegible]	13.0	20700 J	(13	(3.3	87	(2.2	6.3	644 BJ	23.0	9.3	(9.3	25300 J	9.3	2220	248 J	0.2 J	13	1000	(3.3	(0.8	130 BJ	(1.9	(19	43	32 J
[illegible]	[illegible]	[illegible]	[illegible]	15.6	23400 J	(13	(3.3	125	(2.2	4.1	617 BJ	17.0	(0.5	(3.4	27200 J	7.4	1150	188 J	(0.04	15	1010	(3.3	(0.8	153 BJ	(1.9	(19	38	24 J
[illegible]	[illegible]	[illegible]	[illegible]	16.1	6070 J	(13	(3.3	34	(2.1	(2.9	724	7.3	(0.5	(3.3	1170 J	2.1	369	30 J	(0.04	(3.3	192	(3.2	(0.8	113 BJ	(1.9	(19	7.9	8.4 J
[illegible]	[illegible]	[illegible]	[illegible]	11.8	201 J	(13	(3.3	34	(2.1	(3.2	101 BJ	(1.7	(0.6	(3.6	3730 J	2.7	16	(1.8	(0.04	(10	192	(3.4	(0.8	(113 BJ	(1.9	(19	7.8	8.4 J
[illegible]	[illegible]	[illegible]	[illegible]	6.0	7370	:	3.1 J	76	:	:	363	9.3	:	:	8120	14.0 J	762	573	:	:	:	:	:	:	:	3.3 BJ	:	17 BJ
[illegible]	[illegible]	[illegible]	[illegible]	7.0	11300	:	11.0 J	64	:	:	870	10.0	:	9.1	10400	8.0 J	1300	34	:	:	977	:	:	:	:	3.3 BJ	29	19 BJ
[illegible]	[illegible]	[illegible]	[illegible]	3.0	2000	:	1.0 J	41	:	:	61	:	:	:	1270	1.7 J	:	12	:	:	:	:	5.9 J	:	:	7.3 BJ	:	:
[illegible]	[illegible]	[illegible]	[illegible]	7.0	11900	:	4.7 J	50	:	:	565	15.0	:	9.8	11100	4.7 J	1850	140	:	16	1470	:	:	565	:	8.8 BJ	21	41 BJ

* Duplicate analyses
\- Non-detectable; detection limits not specified.
BJ A compound was detected but not in high enough concentrations to confirm its presence.
J Estimated quantity because quality control criteria were not met

K Columbia Formation
UPcc Upper Potomac confining clay
uSP upper Upper Potomac Hydrologic Zone

Table 5.16 (continued)
Organic Analytical Results of February/March 1986
Delaware Sand and Gravel Landfill RI/FS Soil Boring Sampling
(micrograms per kilogram)

Well Number	Sample Number	Depth (ft)	Zone Sampled	Percent Moisture (%)	Toluene	Methylene Chloride	Acetone	2-butanone (MEK)	4-methyl-2-pentanone (MIBK)	Ethyl Benzene	Total Xylene	1,2-dichloroethane	Chloroform	1,1,1-trichloroethane	Phenol	bis-(2-chloroethyl) ether	2-methyl phenol	4-methyl phenol	di-n-butyl phthalate	bis (2-ethyl hexyl) phthalate	Naphthalene	benzoic acid	benzo anthracene
DSC-07	S-1	0-2	C	[illegible]	<7.0	<7.0	13 BJ	<13	<13	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-2	5-7	C	[illegible]	<7.0	<7.0	24 BJ	<15	<15	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-3	10-12	C	[illegible]	<7.0	<7.0	30 BJ	<13	<13	<7.0	<7.0	<7.0	<7.0	<7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-4	15-17	C	[illegible]	<7.0	[illegible]	[illegible]	<13	<15	<7.0	<7.0	<7.0	<7.0	<7.0	<620	<620	<620	<620	9900 BJ	<620	<620	<3200	<620
DSC-07	S-5	20-22	C	[illegible]	<6.0	[illegible] BJ	[illegible]	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<400	<400	<400	<400	2500 BJ	400 BJ	<400	<2000	<400
DSC-07	S-6	25-27	C	[illegible]	<6.0	<6.0	[illegible]	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-7	30-32	C	[illegible]	<6.0	[illegible] BJ	30 BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<500	<500	<500	<500	990 BJ	340 BJ	<500	<2400	<500
DSC-07	S-8	35-37	UPcc	[illegible]	<6.0	<6.0	[illegible]	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-9	[illegible]	[illegible]	[illegible]	<6.0	[illegible]	[illegible]	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-10	[illegible]	[illegible]	[illegible]	<6.0	[illegible]	[illegible]	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-11	[illegible]	[illegible]	[illegible]	[illegible] BJ	[illegible]	[illegible]	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-12	[illegible]	[illegible]	[illegible]	<6.0	10 BJ	[illegible]	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-13	[illegible]	[illegible]	[illegible]	<6.0	[illegible] BJ	[illegible]	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07 *	S-14	65-67	[illegible]	[illegible]	<13	<13	970	[illegible]	[illegible]	<13	<13	<13	<13	<13	<320	<320	<320	<320	1000 BJ	320 BJ	<320	<1600	<320
DSC-07 *	S-14	65-67	[illegible]	[illegible]	<30	<30	1100	[illegible]	[illegible]	<30	<30	<30	<30	<30	<500	<500	<500	<500	1100 BJ	<500	<500	<2400	<500
DSC-07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] BJ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DSC-07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DSC-07	S-17	[illegible]	[illegible]	[illegible]	<6.0	[illegible] BJ	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-18	[illegible]	[illegible]	[illegible]	<6.0	[illegible]	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-19	[illegible]	[illegible]	[illegible]	<6.0	[illegible] BJ	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-20	[illegible]	[illegible]	[illegible]	<6.0	<6.0	[illegible] BJ	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-21	100-102	[illegible]	[illegible]	<6.0	<6.0	[illegible]	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-22	105-107	[illegible]	[illegible]	<6.0	<6.0	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-23	110-112	[illegible]	[illegible]	<6.0	[illegible] BJ	[illegible] BJ	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07 *	S-24	115-117	[illegible]	[illegible]	<6.0	[illegible] BJ	<12	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07 *	S-24	115-117	[illegible]	[illegible]	<6.0	<6.0	<12	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-25	120-122	[illegible]	[illegible]	<6.0	[illegible] BJ	<11	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-26	125-127	[illegible]	[illegible]	<6.0	[illegible] BJ	[illegible] BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-27	130-132	[illegible]	[illegible]	<6.0	[illegible] BJ	<12	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-28	135-137	[illegible]	[illegible]	<6.0	[illegible] BJ	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-29	140-142	[illegible]	[illegible]	<6.0	<6.0	<11	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-07	S-30	145-147	[illegible]	[illegible]	<6.0	6.0 BJ	13 BJ	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-1	0-2	C	27.0	<6.9	9.9 BJ	13 BJ	<14	<14	<6.9	<6.9	<6.9	<6.9	<6.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08 *	S-2	5-7	C	26.0	<8.0	[illegible] BJ	21 BJ	<16	<16	<8.0	<8.0	<8.0	<8.0	<8.0	<350	<350	<350	<350	<350	<350	<350	<2700	<350
DSC-08 *	S-2	5-7	C	26.0	7.0 J	[illegible] BJ	9.5 BJ	<15	<15	<7.7	<7.7	<7.7	<7.7	<7.7	<530	<530	<530	<530	74 J	<530	<530	<2600	<530
DSC-08	S-3	10-12	C	21.0	3.3 J	[illegible] BJ	13 BJ	<14	<14	<7.0	<7.0	<7.0	<7.0	<7.0	<470	<470	<470	<470	130 J	220 J	<470	<2000	<470
DSC-08	S-4	15-17	C	9.0	[illegible]	[illegible] BJ	9.7 BJ	<11	<11	<5.4	<5.4	<5.4	<5.4	<5.4	<370	<370	<370	<370	68 J	78 J	<370	<1800	<370
DSC-08	S-5	20-22	C	11.0	[illegible]	[illegible] BJ	7.0 BJ	<11	<11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-6	25-27	C	15.0	<5.0	[illegible] BJ	8.5 BJ	<12	<12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-7	30-32	C	12.0	[illegible]	[illegible] BJ	14 BJ	<11	<11	<5.7	<5.7	<5.7	<5.7	<5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-8	35-37	UPcc	18.0	[illegible]	[illegible] BJ	30 BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-9	40-42	UPcc	[illegible]	[illegible]	[illegible] BJ	[illegible]	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-10	45-47	UPcc	19.0	3.2 J	10 BJ	9.0 BJ	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	<420	<420	<420	<420	100 J	76 J	<420	<2100	<420
DSC-08	S-11	50-52	UPcc	19.0	<6.2	7.1 BJ	3.6 BJ	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-12	55-57	[illegible]	17.0	2.0 J	11 BJ	16 BJ	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-13	60-62	[illegible]	19.0	<6.2	11 BJ	22 BJ	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-14	65-67	[illegible]	20.0	2.3 J	9.3 BJ	15 BJ	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-15	70-72	[illegible]	17.0	<6.0	7.9 BJ	15 BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-16	75-77	[illegible]	17.0	<6.1	11 BJ	13 BJ	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-17	80-82	[illegible]	20.0	[illegible]	[illegible] BJ	16 BJ	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-18	85-87	[illegible]	[illegible]	[illegible]	[illegible] BJ	36 BJ	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-19	90-92	[illegible]	[illegible]	[illegible]	[illegible] BJ	140	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-20	95-97	[illegible]	[illegible]	[illegible]	[illegible] BJ	80 BJ	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-21	100-102	[illegible]	[illegible]	<6.1	10 BJ	62 BJ	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-22	105-107	[illegible]	20.0	<12	25 BJ	79 BJ	<24	<24	<12	<12	<12	<12	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-23	110-112	[illegible]	22.0	<5.9	13 BJ	260	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-24	115-117	[illegible]	16.0	<10	33 BJ	200	<34	<34	<10	<10	<10	<10	<10	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-25	120-122	MPc	13.0	<5.8	12 BJ	200	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-26	125-127	MPc	13.0	<5.7	10 BJ	160	<11	<11	<5.7	<5.7	<5.7	<5.7	<5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSC-08	S-27	130-132	MPc	16.0	<5.9	10 BJ	130	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Duplicate analyses
NA Sample not analyzed for this compound.
[illegible] identification
BJ [illegible] was detected but not in high enough concentrations to confirm its presence.
J [illegible] quantity because quality control criteria were not met.

C Columbia Formation
UPcc Upper Potomac confining clay
uUP upper Upper Potomac Hydrologic Zone
UPdc Upper Potomac dividing clay
lUP lower Upper Potomac Hydrologic Zone
MPc Middle Potomac clay

Table 5.17
Inorganic Analytical Results for Surface Water

Inorganic Analytical Results of April 1985
Delaware Sand and Gravel Bl/Fl Surface Water Sampling (1)

Sample Location	Iron	Manganese	Chromium	Silver	Zinc	Lead	Cadmium	Mercury	Arsenic	Selenium	Barium	Copper	Calcium	Nickel	Beryllium	Vanadium	Antimony	Thallium	Cobalt	Tin	Aluminum	Magnesium
1a	0.095	0.130	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	(0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1a	0.230	0.160	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	(0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	0.255	0.120	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	(0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	1.010	0.440	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	0.170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	1.050	0.560	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	0.110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	1.640	1.300	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	0.110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	1.000	1.300	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	(0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	0.130	(0.100	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	(0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	1.370	0.630	(0.100	(0.100	(0.100	(0.100	(0.100	(0.001	(0.030	(0.005	0.122	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Sample Location	pH	BOD	Chloride	Ammonia-N	Sulfate	TDS	TOC
1a	6.96	(2.0	27	0.10	23.5	151	7
1a	6.96	(2.0	27	0.10	23.5	137	9
2	6.91	(2.0	29	(0.10	20.0	141	8
3	7.15	(2.0	37	2.00	10.0	136	16
4	7.02	(2.0	43	2.55	14.5	197	24
5	6.61	(2.0	29	0.70	14.5	100	23
6	6.64	3.0	330	(0.10	64.5	733	12
7	6.99	(2.0	6	(0.10	10.5	49	(3
8	6.11	4.0	17	0.25	129.0	366	88

Inorganic Analytical Results of April 1986
Delaware Sand and Gravel Bl/Fl Surface Water Sampling (1)

Sample Location	Iron	Manganese	Chromium	Silver	Zinc	Lead	Cadmium	Mercury	Arsenic	Selenium	Barium	Copper	Calcium	Nickel	Beryllium	Vanadium	Antimony	Thallium	Cobalt	Tin	Aluminum	Magnesium
1	0.190	0.120	(0.010	(0.010	(0.020	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	5.160
1	0.210	0.120	(0.010	(0.010	(0.020	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	5.220
2	0.350	0.170	(0.010	(0.010	(0.020	(0.010	(0.005	0.002	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	5.190
3	0.960	0.320	(0.010	(0.010	(0.020	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	(5.000
4	(0.100	0.140	(0.010	(0.010	(0.020	(0.010	(0.005	0.002	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	(5.000
5	0.580	0.320	(0.010	(0.010	(0.020	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	5.240
6	(0.100	0.040	(0.010	(0.010	(0.020	(0.010	(0.005	0.002	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	(5.000
7a	0.130	(0.010	(0.010	(0.010	(0.020	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	(5.000
7a	(0.100	(0.010	(0.010	(0.010	0.022	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	(5.000
8	1.100	0.010	(0.010	(0.010	0.115	(0.010	(0.005	(0.001	(0.010	(0.005	NA	(0.025	NA	(0.040	(0.005	(0.050	(0.060	(0.010	(0.050	(0.040	(0.200	13.150

1. Gray Creek, East of Route 13
2. Gray Creek, East of Route 13, Upstream of Weir
3. Gray Creek, Pond Entrance
4. Gray Creek, Pond Effluent
5. Gray Creek, Under Railroad Bridge
6. Gray Creek, Tidal Gate, East of Route 9
7. Gravel Pit Pond
8. Intermittent Stream East of DSGP

* Duplicate analyses
NA Sample not analyzed for this parameter.
(1) Units in ppm except pH (dimensionless).

Table 5.16 (continued)
Organic Analytical Results of February/March 1986
Delaware Sand and Gravel Landfill RI/FS Soil Boring Sampling
(micrograms per kilogram)

Well Number	Sample Number	Depth (ft)	Zone Sampled	Percent Moisture (%)	Toluene	Methylene Chloride	Acetone	2-butanone (MEK)	4-methyl-2-pentanone (MIBK)	Ethyl Benzene	Total Xylene	1,2-dichloro ethane	Chloroform	1,1,1-trichloro ethane	Phenol	bis-(2-chloro ethyl) ether	2-methyl phenol	4-methyl phenol	di-n-butyl phthalate	bis (2-ethyl hexyl) phthalate	Naphthalene	benzoic acid	benzo anthracene
DGC-09	9-1	0-2	C	17.0	<26	41 BJ	1200	<32	<32	<26	<26	<26	<26	<26	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-2	5-7	C	18.0	<22	[illegible] BJ	260	<44	<44	<22	<22	<22	<22	<22	<410	<410	<410	<410	<410	<410	<410	<2062	<410
DGC-09	9-3	10-12	C	17.0	<20	[illegible] BJ	260	<40	<40	<20	<20	<20	<20	<20	<400	<400	<400	<400	<400	<400	<400	<2000	<400
DGC-09	9-4	15-17	C	19.0	<6.1	5.7 BJ	290	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-5	20-22	C	12.0	<5.7	[illegible]	160 J	<11	<11	<5.7	<5.7	<5.7	<5.7	<5.7	<300	<300	<300	<300	<300	<300	<300	<1900	<300
DGC-09	9-6	25-27	C	16.0	<15	[illegible]	[illegible]	<30	<30	<15	<15	<15	<15	<15	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-7	30-32	UPcc	17.0	<6.0	[illegible]	270	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-8	35-37	UPcc	[illegible]	<5.8	[illegible]	130	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-9	40-42	UPcc	[illegible]	<5.6	9.7 BJ	64 BJ	<11	<11	<5.6	<5.6	<5.6	<5.6	<5.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-10	45-47	UPcc	[illegible]	<5.9	7.7 BJ	90 BJ	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-11	50-52	UPcc	[illegible]	<5.6	24 BJ	190	<11	<11	<5.6	<5.6	<5.6	<5.6	<5.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-12	55-57	UPcc	[illegible]	<5.8	[illegible] BJ	[illegible]	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-13	60-62	UPcc	15.0	<5.8	13 BJ	[illegible]	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-14	65-67	UPcc	15.0	<5.8	8.8 BJ	[illegible]	<12	<12	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-15	70-72	UPcc	17.0	<5.7	21 BJ	[illegible]	<11	<11	<5.7	<5.7	<5.7	<5.7	<5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09 *	9-16	75-77	UPcc	19.0	<6.2	6.6 BJ	100 BJ	<12	<12	<6.2	<6.2	<6.2	<6.2	<6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09 *	9-16	75-77	UPcc	19.0	<17	19 BJ	700	<34	<34	<17	<17	<17	<17	<17	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-17	80-82	[illegible]	21.0	<6.3	8.3 BJ	74 BJ	<13	<13	<6.3	<6.3	<6.3	<6.3	<6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-18	85-87	[illegible]	21.0	<30	30 BJ	1000 J	360 J	70 J	<30	<30	<30	<30	<30	120 J	<420	<420	<420	<420	62 J	<420	67 J	42 J
DGC-09	9-19	90-92	[illegible]	16.0	25	9.4 BJ	310	21	13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-20	95-97	[illegible]	21.0	<6.3	10 BJ	[illegible]	<13	<13	<6.3	<6.3	<6.3	<6.3	<6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-21	100-102	[illegible]	17.0	<5.9	25 BJ	400	<12	<12	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-22	105-107	[illegible]	17.0	<16	[illegible] BJ	[illegible]	<33	<33	<16	<16	<16	<16	<16	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-23	110-112	[illegible]	19.0	<16	30 BJ	400	<32	<32	<16	<16	<16	<16	<16	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09 *	9-24	115-117	[illegible]	19.0	<6.1	27 BJ	290	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09 *	9-24	115-117	[illegible]	19.0	<17	70 BJ	[illegible]	<33	<33	<17	<17	<17	<17	<17	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-25	120-122	[illegible]	[illegible]	<5.4	7.6 BJ	90 BJ	<11	<11	<5.4	<5.4	<5.4	<5.4	<5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-26	125-127	UPdc	[illegible]	<5.9	11 BJ	34 BJ	<11	<11	<5.9	<5.9	<5.9	<5.9	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-27	130-132	UPdc	[illegible]	<5.4	[illegible] BJ	[illegible]	<11	<11	<5.4	<5.4	<5.4	<5.4	<5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-28	135-137	UPdc	21.0	<12	[illegible]	[illegible]	<24	<24	<12	<12	<12	<12	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-29	140-142	UPdc	17.0	<6.1	12 BJ	[illegible]	<12	<12	<6.1	<6.1	<6.1	<6.1	<6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-30	145-147	UPdc	17.0	<6.0	[illegible] BJ	120 J	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-31	150-152	lUP	12.0	<5.6	[illegible] BJ	150	<11	<11	<5.6	<5.6	<5.6	<5.6	<5.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-32	155-157	lUP	12.0	<5.8	[illegible] BJ	[illegible] BJ	<11	<11	<5.8	<5.8	<5.8	<5.8	<5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-33	160-162	lUP	20.0	<6.3	[illegible] BJ	77 BJ	<13	<13	<6.3	<6.3	<6.3	<6.3	<6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-09	9-34	165-167	MPc	17.0	<6.0	14 BJ	300	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-11	11-1	0-2	C	13.0	<6.0	17 BJ	20 BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<396	<396	<396	<396	140 J	35 J	<396	<1920	<396
DGC-11	11-2	5-7	C	17.0	<6.0	17 BJ	[illegible] P	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<396	<396	<396	<396	91 J	37 J	<396	<1920	<396
DGC-11	11-3	10-12	C	15.0	<6.0	8.0 BJ	160 J	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-13	13-1	[illegible]	C	10.3	<6.0	6.0 BJ	17 BJ	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-13	13-2	[illegible]	C	[illegible]	<6.0	6.0 BJ	14 BJ	<11	<11	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-13	13-3	21-23	C	15.6	<6.0	6.0 BJ	<12	<13	<13	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-16	16-1	[illegible]	C	[illegible]	[illegible]	[illegible]	16 BJ	<12	<12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-16	16-2	[illegible]	C	[illegible]	[illegible]	[illegible]	15 BJ	<11	<11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-16	16-3	[illegible]	C	11.0	<5.3	<5.3	<11	<11	<11	<5.3	<5.3	<5.3	<5.3	<5.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-17	17-2	[illegible]	C	10.0	<5.0	7.0 BJ	23 BJ	<11	<11	<5.0	<5.0	<5.0	<5.0	<5.0	<363	<363	<363	<363	77 J	37 J	<363	<1760	<363
DGC-17	17-3	[illegible]	C	14.0	<6.0	10 BJ	190 J	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
DGC-17	17-4	[illegible]	C	20.0	<6.0	33 BJ	170 J	<12	<12	<6.0	<6.0	<6.0	<6.0	<6.0	<396	<396	<396	<396	150 J	38 J	<396	<1720	<396

* Duplicate analyses
NA Sample not analyzed for this compound.
B Tentative identification
BJ This compound was detected but not in high enough concentrations to confirm its presence.
J Estimated quantity because quality control criteria were not met.
P Preliminary: Blank contamination precludes confirmation of compound presence or quantity.

C Columbia Formation
UPcc Upper Potomac confining clay
uUP upper Upper Potomac Hydrologic Zone
UPdc Upper Potomac dividing clay
lUP lower Upper Potomac Hydrologic Zone
MPc Middle Potomac clay

Table 5.18

Inorganic Analytical Results for Stream Sediments

Inorganic Analytical Results of April 1985
Delaware Sand and Gravel (Landfill RI/FS Stream Sediment Sampling
(in micrograms per gram) (1)

Sample Location	pH	Iron	Manganese	Chromium	Silver	Zinc	Lead	Cadmium	Mercury	Arsenic	Selenium	Barium	Copper	Calcium	Nickel	Beryllium	Vanadium	Antimony	Thallium	Cobalt	Tin	Aluminum	Magnesium
1a	6.96	17,999	167.00	18.49	(10.00	87.27	17.07	(10.00	(0.50	(3.00	(0.50	26.54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1a	6.96	21,382	168.00	15.38	(10.00	78.53	11.68	(10.00	(0.50	(3.00	(0.50	42.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	6.97	4,385	199.00	10.22	(10.00	58.72	142.00	(10.00	(0.50	(3.00	(0.50	38.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	7.13	44,010	774.00	23.50	(10.00	274.00	173.00	(10.00	(0.50	9.28	0.71	234.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	7.02	10,330	390.00	(10.00	(10.00	79.75	73.41	(10.00	(0.50	(3.00	(0.50	79.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	6.84	65,173	1,003.00	14.53	(10.00	153.00	79.41	(10.00	(0.50	5.47	(0.50	145.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	6.94	27,462	1,170.00	14.53	(10.00	215.25	34.92	(10.00	(0.50	11.25	(0.50	74.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	6.93	3,861	24.26	(10.00	(10.00	23.24	10.11	(10.00	(0.50	(3.00	(0.50	(10.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	6.11	10,239	87.02	11.57	(10.00	72.66	31.69	(10.00	(0.50	(3.00	(0.50	57.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Inorganic Analytical Results of April 1986
Delaware Sand and Gravel (Landfill RI/FS Stream Sediment Sampling
(in micrograms per gram) (1)

Sample Location	% Moist.	Iron	Manganese	Chromium	Silver	Zinc	Lead	Cadmium	Mercury	Arsenic	Selenium	Barium	Copper	Calcium	Nickel	Beryllium	Vanadium	Antimony	Thallium	Cobalt	Tin	Aluminum	Magnesium
1	33.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.26	NA	NA	(0.50	NA	(4.03	(1.00	NA	NA	NA	NA
1	34.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.54	NA	NA	(0.48	NA	(3.87	(0.97	NA	NA	NA	NA
2	44.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.23	NA	NA	0.49	NA	(3.95	(0.99	NA	NA	NA	NA
3	39.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	87.97	NA	NA	1.96	NA	(3.94	(0.99	NA	NA	NA	NA
4	29.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.32	NA	NA	(0.48	NA	(3.86	(0.97	NA	NA	NA	NA
5	42.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	63.13	NA	NA	0.81	NA	(3.97	(0.97	NA	NA	NA	NA
6	38.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	43.56	NA	NA	(0.50	NA	(4.10	(1.01	NA	NA	NA	NA
7a	27.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.47	NA	NA	(0.49	NA	(3.94	(0.99	NA	NA	NA	NA
8	30.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13.33	NA	NA	0.63	NA	(4.02	(1.00	NA	NA	NA	NA

1. Army Creek, West of Route 13
2. Army Creek, East of Route 13, Upstream of Weir
3. Army Creek, Pond Entrance
4. Army Creek, Pond Effluent
5. Army Creek, Under Railroad Bridge
6. Army Creek, Tidal Gate, East of Route 9
7. Gravel Pit Pond
8. Intermittent Stream East of DDSB

a Duplicate analyses
NA Sample not analyzed for this parameter.
(1) Units in micrograms per gram, except percent moisture (%) and pH (dimensionless).

Table 5.22

Inorganic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Groundwater Sampling
(micrograms per liter)

well #	Lab	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	Sn	V	Zn
2r	CLP	309	(26	(10	96	(1.0	(5.0	1530 J	(5.0	(7.0	4.3 BJ	6860	(5.0	519	223	(0.1	6.5	894	(5.0	(3.0	6870 BJ	(10	(16	(5.0	23 BJ
2s	CLP	19	(26	(10	39	(1.0	(5.0	6630 J	(5.0	(7.0	4.3 BJ	23600	(5.0	2460	334	(0.1	7.5	1470	(5.0	(3.0	9490 J	(10	(16	(5.0	25 BJ
13r	CLP	(23	(26	(10	29	(0.4	(0.4	15000	(4.0	(6.0	7.9	60	(5.0	8750	85	(0.1	14.0	2730	(5.0	(4.0	20900	(10	(16	(5.0	72
13s	CLP	(23	(26	(10	29	(0.4	(0.4	15000	(4.0	(6.0	7.9	60	(5.0	8750	85	(0.1	14.0	2730	(5.0	(4.0	20900	(10	(16	(5.0	72
63	CLP	(19	(26	(10	56	(1.0	(5.0	9210 J	(5.0	(7.0	3.0 BJ	71	(5.0	3460	322 J	(0.1	46.0	2570	(5.0	(3.0	9480 J	(10	(16	(5.0	34 J
63	CLP	(19	(26	(10	56	(1.0	(5.0	9210 J	(5.0	(7.0	3.0 BJ	71	(5.0	3460	322 J	(0.1	46.0	2570	(5.0	(3.0	9480 J	(10	(16	(5.0	34 J
64	CLP	(23	(26	(10	33	(0.4	(0.4	5620	(4.0	(6.0	7.1	50	(5.0	1640	27	(0.1	8.7	1590	(5.0	(4.0	5720	(10	(16	(5.0	25
64	CLP	(23	(26	(10	33	(0.4	(0.4	5620	(4.0	(6.0	7.1	50	(5.0	1640	27	(0.1	8.7	1590	(5.0	(4.0	5720	(10	(16	(5.0	25
65	CLP	(23	(26	(10	33	(0.4	(0.4	6370	(4.0	7.7	5.6	275	(5.0	2360	148	(0.1	7.6	2060	(5.0	(4.0	6470	(10	(16	(5.0	63
65	CLP	(23	(26	(10	34	(0.4	(0.4	3990	(4.0	9.2	6.0	50	(5.0	780	64	(0.1	13.0	1860	(5.0	(4.0	6470	(10	(16	(5.0	63
BMW-2	CLP	(19	(26	(10	61	(1.0	(5.0	7790 J	(5.0	(7.0	9.8 BJ	26	(5.0	3890	5.7 J	(0.1	(6.0	1280	(5.0	(3.0	6970 J	(10	(16	(5.0	9.2 BJ
BMW-3	CLP	(19	(26	(10	58	(1.0	(5.0	6430 J	(5.0	(7.0	6.9 BJ	116	(5.0	2980	(4.0	(0.1	(6.0	1310	(5.0	(3.0	5700 J	(10	(16	(5.0	11 BJ
BMW-4	CLP	(19	(26	(10	58	(1.0	(5.0	6430 J	(5.0	(7.0	6.9 BJ	116	(5.0	2980	5.4	(0.1	(6.0	1310	(5.0	(3.0	5700 J	(10	(16	(5.0	11 BJ
BMW-5	CLP	(19	(26	(10	72	(1.0	(5.0	8190 J	(5.0	(7.0	32 BJ	84	(5.0	3930	(10	(0.2	9.0	1830	(5.0	(3.0	23100 J	(10	(16	(5.0	17 BJ
BMW-5	CLP	(19	(26	(10	72	(1.0	(5.0	8190 J	(5.0	(7.0	32 BJ	84	(5.0	3930	(10	(0.2	9.0	1830	(5.0	(3.0	23100 J	(10	(16	(5.0	17 BJ
BMW-6	CLP	(19	(26	(10	72	(1.0	(5.0	8070 J	9.5	(7.0	34 BJ	44	(5.0	3630	6.5	(0.1	7.9	1430	(5.0	(3.0	23100 J	(10	(16	(5.0	17 BJ
D-4	CLP	48	(26	(10	309	(1.0	(5.0	5130 J	9.0	54.0	3.0 BJ	20800	(5.0	1730	1640	(0.1	23.0	2520	(5.0	(3.0	8740 J	(10	(16	(5.0	34
D-5	CLP	(23	(26	(10	16	(0.4	(0.4	5670	(4.0	(6.0	(4.0	409	(5.0	1810	43	(0.1	(6.0	1940	(5.0	(4.0	7330	(10	(16	(5.0	19
BMC-01d	CLP	881	(26	(10	34	(1.0	(5.0	17500 J	4.5	(7.0	3.6 BJ	1090	(5.0	5260	609	(0.1	(6.0	3870	(5.0	(3.0	8770 J	(10	(16	(5.0	20 BJ
BMC-01s	CLP	110	(26	(10	152	(1.0	(5.0	13900 J	8.0	32.0	5.1 BJ	2630	(5.0	4410	207	(0.1	19.0	9260	(5.0	(3.0	9780 J	(10	(16	(5.0	69
BMC-02d	CLP	30	(26	(10	90	(1.0	(5.0	7740 J	(5.0	(7.0	3.6 BJ	51	(5.0	1940	6.5 J	(0.1	(6.0	25200	(5.0	(3.0	20600 J	(10	(16	(5.0	5.3 BJ
BMC-02s	CLP	60	(5	16	88	(2.0	(0.5	NA	(2.0	15.0	(5.0	38000	(10.0	8600	1770	(0.2	10.0	NA	(2.0	(0.5	NA	(2	(10	(50.0	60
BMC-03s	CLP	60	(26	(10	123	(1.0	(5.0	10700	6.1	11.0	7.7	39000	(5.0	8510	1700	(0.1	(6.0	6920	(5.0	(3.0	27900 J	(10	(16	(5.0	32 J
BMC-03s	CLP	60	(26	(10	123	(1.0	(5.0	10700	6.1	11.0	7.7	39000	(5.0	8510	1700	(0.1	(6.0	6920	(5.0	(3.0	27900 J	(10	(16	(5.0	32 J
BMC-03s	CLP	(19	(26	(10	60	(1.0	(5.0	9310 J	9.3	(7.0	(3.0	188	(5.0	3090	104 J	(0.1	(6.0	2910	(5.0	(3.0	7480 J	(10	(16	(5.0	27 J
BMC-03s	CLP	30	(26	(10	1560	(1.0	(5.0	26000	9.0	37.0	4.5	31000	(5.0	13200	8520	(0.1	7.6	26400	(5.0	(3.0	47900 J	(10	(16	(5.0	59 J
BMC-04d	CLP	30	(26	(10	216	(1.0	(5.0	22900	8.5	43.0	3.6	78000	3.7	18700	3030	(0.1	15.0	4870	(5.0	(3.0	33600 J	(10	(16	(5.0	63 J
BMC-04d	CLP	30	(26	(10	216	(1.0	(5.0	22900	8.5	43.0	3.6	78000	(5.0	18500	3010	(0.1	12.0	4660	(5.0	(3.0	31500 J	(10	(16	(5.0	63 J
BMC-04d	CLP	30	(26	(10	209	(1.0	(5.0	22400	8.4	43.0	(3.0	78000	(5.0	5470	7970	(0.1	31.0	2160	(5.0	(4.0	14900	(10	(16	(5.0	17
BMC-05	CLP	(23	(26	(10	649	(0.4	(0.4	7480	(4.0	110.0	(4.0	61000	(5.0	9700	6610	(0.1	6.4	5080	(5.0	(3.0	36700 J	(10	(16	(5.0	32 J
BMC-06d	CLP	26	(26	(10	884	(1.0	(5.0	10900	5.0	106.0	4.3	37500	12.0	9900	6610	(0.1	6.4	5080	(5.0	(3.0	36700 J	(10	(16	(5.0	32 J
BMC-06d	CLP	26	(26	(10	884	(1.0	(5.0	10900	5.0	106.0	4.3	37500	12.0	9900	6610	(0.1	6.4	5080	(5.0	(3.0	NA	(2	(10	(50.0	36
BMC-06s	CLP	50	(5	(5	88	(2.0	(0.5	NA	(2.0	106.0	(5.0	34000	10.0	9950	6740	(0.2	10.0	NA	(2.0	(0.5	NA	(2	(10	(50.0	36
BMC-06s	EA	50	(5	(5	88	(2.0	(0.5	NA	(2.0	106.0	(5.0	34000	10.0	9950	6740	(0.2	10.0	NA	(2.0	(0.5	NA	(2	(10	(50.0	36
BMC-07d	CLP	20	(26	(10	93	(1.0	(5.0	8460 J	(5.0	(7.0	7.1 BJ	77	(5.0	1920	176 J	(0.1	(6.0	1660	(5.0	(4.0	11200 J	(10	(16	(5.0	47 J
BMC-07d	CLP	20	(26	(10	93	(1.0	(5.0	8460 J	(5.0	(7.0	7.1 BJ	77	(5.0	1920	176 J	(0.1	(6.0	1660	(5.0	(4.0	11200 J	(10	(16	(5.0	47 J
BMC-07s	CLP	60	(26	(10	211	(1.0	(5.0	48700	5.6	95.0	3.7	14000	1370.0	20000	5120	(0.1	27.0	3500	(5.0	(3.0	21600 J	(10	(16	(5.0	42 J
BMC-08d	CLP	(19	(26	(10	105	(1.0	(5.0	6670 J	8.3	51.0	10 BJ	1520	(5.0	1700	564	(0.1	13.0	3500	(5.0	(3.0	8180 J	(10	(16	(5.0	23 BJ
BMC-08s	CLP	(19	(26	(10	779	(1.0	(5.0	23700 J	(5.0	137.0	3.0 BJ	33000	(5.0	15000	9390 J	(0.1	(6.0	4850	(5.0	(3.0	20700 J	(10	(16	(5.0	12 BJ
BMC-09d	CLP	(19	(26	(10	34	(1.0	25.0	15800 J	9.0	(7.0	6.2 BJ	47	(5.0	2870	174	(0.1	7.9	4610	(5.0	(3.0	17600 J	(10	(16	(5.0	21 BJ
BMC-09s	CLP	(19	(26	(10	34	(1.0	25.0	15800 J	9.0	(7.0	6.2 BJ	47	(5.0	2880	166	(0.1	(6.0	4610	(5.0	(3.0	17700 J	(10	(16	(5.0	69
BMC-09s	CLP	32	(26	(10	413	(1.0	(5.0	11800 J	7.5	17.0	5.7 BJ	1530	(5.0	6470	346	(0.1	14.0	4660	(5.0	(3.0	17900 J	(10	(16	(5.0	22 BJ
BMC-09s	CLP	(19	(26	(10	27	(1.0	(5.0	15700 J	6.7	(7.0	6.0 BJ	47	(5.0	2880	166	(0.1	(6.0	4610	(5.0	(3.0	17900 J	(10	(16	(5.0	69
BMC-10d	CLP	213	(26	(10	1440	(0.4	(4.0	157000	23.0	(6.0	7.3	23	(5.0	(309	3.3	(0.1	(6.0	410000	(5.0	(4.0	147000	(10	(16	(5.0	71
BMC-10s	CLP	(23	(26	(10	162	(0.4	(4.0	7770	(4.0	(6.0	6.7	230	(5.0	1610	38	(0.1	(6.0	4000	(5.0	(4.0	8720	(10	(16	(5.0	33
BMC-11d	CLP	44	(26	(10	113	(0.4	(4.0	33000	(4.0	(6.0	8.2	166	(5.0	3140	33	(0.1	(6.0	5720	(5.0	(4.0	6600	(10	(16	(5.0	61
BMC-11s	CLP	44	(26	(10	113	(0.4	(4.0	33000	(4.0	(6.0	8.2	166	(5.0	3140	33	(0.1	(6.0	5720	(5.0	(4.0	6600	(10	(16	(5.0	61
BMC-12d	CLP	(19	(26	(10	84	(1.0	(5.0	7900 J	8.0	(7.0	7.0 BJ	690	(5.0	1700	88	(0.1	(6.0	1800	(5.0	(3.0	9710 J	(10	(16	(5.0	8.9 BJ
BMC-12s	CLP	30	(26	(10	715	(1.0	(5.0	92400 J	9.3	(7.0	5.4 BJ	63	(5.0	(295	(4.0	(0.1	(6.0	70100	(5.0	(3.0	74700 J	(10	(16	(5.0	8.9 BJ
BMC-13	EA	100000	(5	8	NA	2.0	(1.0	NA	(2.0	11.0	29	41000	30.0	16700	480	(0.2	44.0	NA	(2.0	1.0	NA	(2	(10	60.0	60
MW-10 *	CLP	(19	(26	(10	103	(1.0	(5.0	8270 J	8.3	19.0	6.4 BJ	416	(5.0	4350	270	(0.1	9.6	2950	(5.0	(3.0	10600 J	(10	(16	(5.0	9.5 BJ
MW-10 *	CLP	77	(26	(10	106	(1.0	(5.0	8560 J	9.5	24.0	5.6 BJ	490	(5.0	4690	270	(0.1	11.0	3080	(5.0	(3.0	11000 J	(10	(16	(5.0	9.4 BJ
MW-11	CLP	(19	(26	(10	177	(1.0	(5.0	10300 J	(5.0	15.0	6.3 BJ	6330	(5.0	6130	667 J	(0.1	(6.0	2330	(5.0	(3.0	14500 J	(10	(16	(5.0	12 BJ
MW-12	CLP	23	(26	(10	149	(1.0	(5.0	11300 J	9.0	8.9	4.7 BJ	9250	16.0	6240	690	(0.1	(6.0	9060	(5.0	(3.0	24600 J	(10	(16	(5.0	16 BJ
MW-13	CLP	(23	(26	(10	72	0.5	(4.0	7440	(4.0	10.0	6.5	3640	(5.0	2950	507	(0.1	(6.0	1770	(5.0	(4.0	9380	(10	(16	(5.0	36
MW-14	CLP	30	(26	(10	158	(1.0	(5.0	11700 J	8.0	9.5	5.5 BJ	5840	(5.0	7390	831	(0.1	6.0	9130	(5.0	(3.0	15200 J	(10	(16	(5.0	10 BJ
27	CLP	(19	(26	(10	211	(1.0	(5.0	8440 J	(5.0	22.0	3.5 BJ	11200	(5.0	6600	610 J	(0.1	(6.0	12300	(5.0	(3.0	26700 J	(10	(16	(5.0	7.3 BJ
28	CLP	(19	(26	(10	236	(1.0	(5.0	11700 J	7.3	31.0	5.4 BJ	16700	(5.0	7200	1120	(0.1	6.2	9050	(5.0	(3.0	36700 J	(10	(16	(5.0	7.3 BJ
29	CLP	(19	(26	(10	272	(1.0	(5.0	17900 J	6.0	25.0	4.9 BJ	23000	(5.0	12400	2250	(0.2	(6.0	13900	(5.0	(3.0	70100 J	(10	(16	(5.0	7.3 BJ
31 *	EA	50	(5	(5	NA	(2.0	(0.5	NA	(2.0	(0.0	(5.0	11000	(10.0	4360	910	(0.2	4.0	NA	(2.0	(0.5	NA	(2	(10	(50.0	(50
31 *	CLP	19	(26	(10	100	(1.0	(5.0	8610 J	8.3	7.2	3.3 BJ	10500	(5.0	4350	833	(0.1	(6.0	3310	(5.0	(3.0	16400 J	(10	(16	(5.0	9.9 BJ

* Duplicate analyses
NA Sample not analyzed for this parameter.

Table 5.23

Organic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Groundwater Sampling
(micrograms per liter)

Well #	Lab	Acetone	1,1-dichloroethane	2-butanone (MEK)	1,2-dichloroethane	ethylbenzene	total xylenes	bis(2-ethylhexyl) phthalate	benzene	toluene	bis(2-chloroethyl) ether	methylene chloride	trichloroethene (TCE)	vinyl chloride	4-methyl-2-pentanone (MIBK)	2-methylphenol (o-cresol)
3a	EAP	15 B	5 U	13 B	5 U	5 U	5 U	3 J	5 U	3 J	10 U	5 U	5 U	10 U	10 U	10 U
3b	EAP	15 B	5 U	13 B	5 U	5 U	5 U	10 B	5 U	5 U	10 U	2 BJ	5 U	10 U	10 U	10 U
3c	EAP	15 B	5 U	11 B	5 U	5 U	5 U	8 B	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
4a	EAP	15 B	5 U	10 B	5 U	5 U	5 U	9 B	5 U	7	10 U	5 U	2 J	10 U	3 J	10 U
4b	EAP	16 B	5 U	9 B	5 U	3 J	5 U	17 B	5 U	5 U	3 J	5 U	5 U	10 U	10 U	10 U
4c	EAP	7 B	5 U	11 B	5 U	5 U	5 U	6 B	5 U	5 U	10 U	5 U	1 J	1 J	10 U	10 U
5	EAP	8 B	5 U	10 B	5 U	5 U	5 U	23 B	5 U	5 U	10 U	2 BJ	140	10 U	10 U	10 U
MW-1	EAP	8 B	5 U	10 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-1	EAP	9 B	5 U	9 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-2	EAP	(46)	5 U	(20)	5 U	5 U	5 U	10 U	5 U	5 U	2 J	(26)	5 U	2 J	10 U	-
MW-2	EAP	9 B	5 U	10 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-2	EAP	10 B	5 U	9 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
B-1	EAP	9 B	5 U	10 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	1 BJ	5 U	10 U	10 U	10 U
B-3	EAP	101 B	5 U	17 B	5 U	5 U	4 J	4 BJ	1 J	1 J	10 U	10 BJ	5 U	10 U	1 J	10 U
MW-01d	EAP	7 B	5 U	9 B	5 U	5 U	5 U	3 BJ	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-01c	EAP	6 B	5 U	9 B	5 U	5 U	5 U	4 J	5 U	5 U	4 J	1 BJ	5 U	10 U	10 U	10 U
MW-02d	EAP	17 B	5 U	11 B	5 U	1 J	2 J	2 BJ	7	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-02c	EAP	(1900) B	(230)	1100 B	(230)	140 J	720	2 BJ	690	2100	310	(230)	(230)	(360)	310 J	25
MW-02c	EA	(1700)	(30)	970	21	160 J	690	(20)	670	2200	310	(280)	(20)	(20)	330	-
MW-03d	EAP	20 B	5 U	12 B	5 U	1 J	4 J	7	5 U	5 U	10 U	5 U	5 U	10 U	4 J	10 U
MW-03c	EAP	(1300) B	(230)	(1200) B	(230)	180 J	(1100)	10 B	530	2000	220	(230)	(230)	(360)	650	300
MW-04d	EAP	(1300) B	(230)	(1000) B	(230)	150 J	(1100)	10 B	1300	4700	140	(230)	(230)	(360)	360	43
MW-04s	EAP	(1300) B	(230)	(1000) B	(230)	150 J	(1100)	10 B	1300	4700	140	(230)	(230)	(360)	360	47
MW-04c	EAP	23 B	5 U	10 B	5 U	1 J	2 J	2 BJ	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-04c	EAP	(1200) B	(230)	(1200) B	(230)	150 J	310	2 BJ	1100	3900	55	(44) BJ	(230)	(360)	(360)	3 J
MW-04c	EA	(1200)	(60)	850	(60)	230	310	(20)	1200	4100	50	(680)	60	60	210	-
MW-05d	EAP	23 B	5 U	10 B	5 U	1 J	4 J	2 BJ	5 U	5 U	10 U	1 BJ	5 U	10 U	10 U	10 U
MW-05s	EAP	320 B	50	320 B	5 U	140 J	240	7	1100	3900	36	(36) BJ	130	10 J	63 J	10 U
MW-06d	EAP	8 B	5 U	8 B	5 U	2 J	2 J	2 BJ	5 U	5 U	10 U	2 BJ	5 U	10 U	10 U	10 U
MW-06c	EAP	72 B	5 U	57 B	5 U	5 U	5 U	6 B	5 U	5 U	10 U	2 BJ	5 U	10 U	10 U	10 U
MW-07d	EAP	3 J	5 U	4 J	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-07s	EAP	11 B	5 U	6 J	5 U	5 U	5 U	15 B	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-08d	EAP	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-09s	EAP	420	5 U	120 B	5 U	21	50	10 U	5 U	5 U	17	3 BJ	5 U	10 U	11	10 U
MW-09s	EA	630	5 U	110 B	5 U	8	10	10 U	5 U	5 U	2 J	2 BJ	5 U	10 U	6 J	10 U
MW-10d	EAP	21 B	5 U	10 B	5 U	5 U	3 J	5 U	5 U	2 J	10 U	5 U	5 U	10 U	10 U	10 U
MW-10s	EAP	1200 B	5 U	8 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	2 BJ	1 J	10 U	10 U	10 U
MW-11d	EAP	8 B	5 U	8 B	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-11s	EAP	15 B	5 U	7 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-12d	EAP	9 B	5 U	11 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	3 J	5 U	10 U	10 U	10 U
MW-12s	EAP	17 B	5 U	12 B	5 U	5 U	5 U	4 J	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-13d	EAP	9 B	5 U	10 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	2 BJ	5 U	10 U	10 U	10 U
MW-13s	EA	(46)	2 J	(20)	2 J	5 U	(10)	(20)	2 J	2 J	2 J	(20)	2 J	2 J	10 U	-
MW-14d	EAP	4 B	5 U	5 U	5 U	5 U	5 U	2 BJ	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
MW-14s	EAP	4 B	5 U	(10)	5 U	5 U	5 U	(10)	5 U	5 U	10 U	1 BJ	5 U	10 U	10 U	10 U
MW-15	EAP	8 B	5 U	9 B	5 U	5 U	5 U	3 BJ	5 U	5 U	4 J	5 U	5 U	10 U	10 U	10 U
MW-16	EAP	6 B	5 U	10 B	5 U	5 U	5 U	2 BJ	5 U	5 U	4 J	5 U	5 U	10 U	10 U	10 U
27	EAP	7 BJ	5 U	9 B	5 U	5 U	5 U	2 BJ	5 U	5 U	10 U	3 BJ	5 U	10 U	10 U	10 U
28	EAP	8 B	5 U	9 B	5 U	5 U	5 U	3 BJ	5 U	5 U	4 J	5 U	5 U	10 U	10 U	10 U
29	EAP	8 B	5 U	9 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	10 U	10 U	10 U
31 d	EAP	18 B	5 U	7 B	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	2 J	10 U	10 U	10 U
31 s	EA	(46)	2 J	(20)	2 J	5 U	8 J	(20)	2 J	8 J	10 U	(11) BJ	5 U	(20)	2 J	10 U	4 J	4 J
																-

* Duplicate analyses
\- Analytical data is not available.
J Estimated quantity because quality control criteria were not met.
P Preliminary: Blank contamination precludes confirmation of compound presence and quantity.
BJ A compound was detected but not in high enough concentrations to confirm its presence.

Table 5.23 (cont'd)

Organic Analytical Results of April, 1986
Delaware Sand and Gravel Landfill RI/FS Groundwater Sampling
(micrograms per liter)

Well #	Lab	di-n-butyl phthalate	1,2-dichloro ethane	chloro benzene	1,4-dichloro benzene	styrene	4-methyl phenol (p-cresol)	benzoic acid	naph-thalene	diethyl phthalate	phenol	benzyl alcohol	1,2-dichloro benzene	chloro-form	tetra chloro ethene (PCE)	2,4-dimethyl phenol	2,4-dichloro phenol
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-[illegible]	CLP	<10	9	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-03 *	EA	<2	<2	<2	<2	-	-	-	<2	<2	<2	-	<2	<2	<2	<2	<4
DRC-03 *	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-03 *	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
[illegible]	CLP	<10	5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-01d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-01s	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-02d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-02s *	CLP	<10	<250	<250	<10	60 J	41	210	2 J	3 J	60	3 J	<10	<250	<250	4 J	<10
DRC-02s *	EA	<2	<20	<20	<2	-	-	-	3	2	95	-	<2	<20	<20	6	<4
DRC-03d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-03s	CLP	<50	<250	<250	<50	<250	25 J	80 J	<50	<50	<10	<50	10 J	<250	<250	<50	<50
DRC-04 *	CLP	<60	2600	<250	<60	120 J	310	<300	<60	<60	1200	<60	<60	<250	<250	<60	13 J
DRC-04 *	CLP	<60	3000	<250	<60	175 J	260	<700	6 J	8 J	1700	16 J	<60	<250	<250	6 J	16 J
DRC-05	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-06 *	CLP	<10	<250	<250	<10	<250	<10	65	2 J	<10	<10	<10	<10	<250	<250	<10	<10
DRC-06 *	EA	<2	76	<60	<2	-	-	-	<2	<2	12	-	<2	<60	<90	<2	<4
DRC-07d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-07s	CLP	<10	300	24 J	<10	<50	<10	10 J	7 J	<10	<10	<10	<10	13 J	12 J	<10	<10
DRC-08d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-08s	CLP	<10	<25	10 J	<10	<25	<10	<50	<10	<10	<10	<10	<10	<25	<25	<10	<10
DRC-09c	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-09d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-09s *	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-09s *	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-10d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-10s	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-11d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-11s	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-12d	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-12s	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-13 *	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
DRC-13 *	EA	<2	<2	<2	<2	-	-	-	<2	<2	<2	-	<2	<2	<2	<2	<4
MW-10 *	CLP	<10	33	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
MW-10 *	CLP	<10	30	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
MW-11	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
MW-12	CLP	<10	<5	5	3 J	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
MW-13	CLP	<10	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
MW-14	CLP	<10	<5	5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
27	CLP	<10	<5	2 J	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
28	CLP	<10	6	5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
29	CLP	<10	7	22	9 J	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
31 *	CLP	2 J	<5	<5	<10	<5	<10	<50	<10	<10	<10	<10	<10	<5	<5	<10	<10
31 *	EA	<2	<2	<2	<2	-	-	-	<2	<2	<2	-	<2	<2	<2	<2	<4

* Duplicate analyses
\- Analytical data is not available.
J Estimated quantity because quality control criteria were not met.

APPENDIX B

RESPONSIVENESS SUMMARY

XI. RESPONSIVENESS SUMMARY

As called for in Section 117 of Superfund Amendments and Reauthorization Act of 1986, DNREC and EPA has presented the proposed plan for public review. DNREC and EPA accepted written comments on the proposed plan and draft Remedial Investigation, Feasibility Study until April 18, 1988. A public meeting was held on March 16, 1988 at the New Castle DNREC building in New Castle Delaware to discuss the proposed remedial action directed toward addressing sources of contamination by removal and on-site incineration as well as addressing remediation of the groundwater contamination plume. The Responsiveness Summary details the comments received from interested citizens during the public comment period. The discussions answer the most prevalent concerns expressed by citizens, as well as addressing individual comments. Verbatim transcripts of the public meeting, written comments, meeting notes, telephone memoranda, newspaper accounts, and notes made following conversations were used when compiling the comments.

Subject: Groundwater Contamination

1. A Resident on Route 9 with a private well was concerned about contamination reaching his well in the future.

   EPA/DNREC assured the citizen that the plume should not migrate in the direction of his residence now or during the remedial action. Continued monitoring of the plume will occur during the remedial action. If contamination moves toward residential wells, those residential wells would be continually monitored to insure no risk to those receptors occurs.

2. New Castle County expressed concerns on how those who read portions of the RI/FS may make conclusions that contamination (Specifically 1,2-dichloroethane) at AWC-7 is a result of Army Creek Landfill.

DNREC/EPA assured the county that due to insufficient sampling and analysis that we were not making any conclusions about Army Creek Landfill. DS & G Remedial Investigation Executive Summary page 1 states "As indicated by the solute transport modeling, the source of the 1,2 dichloroethane contamination is not likely DS & G. The source is likely west of DS & G, but sampling and analysis was not sufficient to identify the source of this contamination. A formal response to the county was drafted and is attached to this responsiveness summary.

3. New Castle County suggested that Delaware Sand and Gravel may actually be the source of the 1,2 - dichlorethane contamination at AWC-7. Although the RI report notes that there was a potential for DS & G contamination reaching AWC-G3, the observed groundwater quality data do not support this. Despite the fact that 1,2 dichloroethane was detected near the DS & G Drum Disposal Area, the concentration values decrease rapidly moving away from the Area. Finally, balancing information on observed water quality trends and historical plume shapes with the simulated flow and transport results simply does not support DS & G as a potential source of contamination at AWC-7.

4. New Castle County suggested that other areas may be the source of the 1,2 dichloroethane contamination at AWC-7. Evan though not all

of the listed sources were evaluated, it is felt that none of these are likely candidates because of the thickness of the clay confining layer, the distance from AWC-7, or the fact that the contamination would have to be detected in either AWC-2 or AWC-6 first and this has not been observed. The analysis of flow paths, groundwater quality, and geolgy suggest that Army Creek Landfill seems to be the source of 1,2 dichloroethane contamination prior to 1982, when additional recovery wells were installed. With the new recovery wells, potential flow paths from Army Creek Landfill to AWC-7 seem to have been eliminated and water quality improvements in AWC-7 have been realized since then.

5. New Castle County feels that the groundwater modeling in the DS & G RI/FS is not correct because the model had contamination emanating from Army Creek Landfill prior to that from DS & G, the model kept RW-3 in operation for six years after it was shut off, and the model was not calibrated as rigorously as possible.

   For the model, it was assumed that leaching of contaminants and contaminant migration away from Army Creek Landfill began before DS & G because wastes were placed there earlier. Even though the exact leaching events and pathways are unknown, the "times of initiation" are not far enough in error to cause a significant change in the past - 1982 simulated results. As far as RW-3 is concerned, the additional pumpage (actually four years, not six) should not significantly alter the simulation results, eaxcept maybe to enhance the maintenance of a stronger groundwater divide. Finally, the modeling calibration was done in accordance with accepted methods

but, due to the extreme complexity of the system and the simplifications involved in the model, it was not possible to develop a fully calibrated numerical model capable of matching the observed heads at all times. Regardless, the calibration of the model was sufficient to evaluate the contaminant transport in the vicinity of DS & G and Army Creek Landfill. A more rigorous calibration would not have significantly affected the conclusions based on the existing simulations.

Subject: Surface Debris and Continued Dumping

1. A resident of Grantham lane commented on the surface debris and continued dumping on the inert area.

   EPA/DNREC assured the resident that the surface debris would be removed during the remedial action. DNREC's Waste Management Section is addressing the continued dumping of material in this area.

Subject: Incineration

1. A representative of the area expressed concerns about emissions (chemical and odor) from the stack of the incinerator.

   EPA/DNREC assured the public emissions would have to meet stringent requirements of RCRA and Air Pollution Control Regulations. In meeting these requirements emissions and odor would be reduced to minimal amounts which would not be harmful to the public health or environment.

2. A representative was concerned with how long the incineration would take to complete.

EPA/DNREC estimates incineration will take 3 to 5 years.

3. The question was asked if off-site incineration was considered. EPA/DNREC did consider off-site incineration; however, the risks of transportation and the additional costs of transportation and usage of an off-site incinerator did not make this alternative the best overall.

4. A PRP questioned how an incinerator could be operated without proper characterization of the wastes.

   EPA/DNREC have required in the selected alternative that waste be further characterized and treatability studies be completed in order to determine the proper type of incinerator to be mobilized in order to meet performance standards required by RCRA, and Air Pollution Control Regulations.

Subject: Costs of Treatment and Recovery Wells

1. New Castle County requested more detailed documentation of implementation of 5 Recovery Well Systems and treatment of groundwater.

   Alternative 1 - 5 Recovery well system

Implementation Capital Costs -	$ 322,130
O & M 10 years -	759,613
	$1,081,743

Alternative 2 -	
Costs from Alt. 1	$1,081,743
Capital Costs Treatment System	1,096,818
for 5 recovery wells	
O & M for 10 years	2,574,888
	$4,753,450

Subject: Remedial Action for Inert, Ridge and Grantham South Areas

1. The PRP group stated that based on the technical information it does not appear that any special remedial action is required for the Inert Disposal, Grantham South or Ridge Area.

   DNREC/EPA has documented direct contact risk to surface soils in the Ridge Area, warranting remedial action.

   In section 121 of SARA all remedies must be consistence with any applicable relevant or appropriate requirements. A no action at the inert area would not meet the applicable closure requirements of the Delaware Solid Waste Regulations. The selected alternative, surface debris removal and capping is consistent with the Delaware Solid Waste Regulations.

   Also a no action at the Grantham South Area would not be consistent with closure requirements under RCRA. Capping this area, the selected alternative, would attain this relevant and appropriate ARAR.

Subject: Evacuation of Wastes

1. New Castle County expressed concerns about openning and subsequent disturbance of the Drum Disposal and Ridge Areas. They feel this action could result in significantly greater concentrations of contaminants in the recovery wells which may negatively impact upon the design and operation of the treatment system.

   DNREC/EPA recognizes that disturbance of the waste in the Drum Disposal Area may increase the groundwater contaminant concentrations for a short period of time during and immediately after excavation. This potential scenerio will be investigated in the remedial design phase and handled in such a manner was as to minimize impact to the treatment facility.

2. A FRP stated the risk associated with excavating the wastes and exposing them to ambient air had not been quantified. DNREC/EPA recognize a short-term risk to on-site workers from the excavation of the Drum Disposal Area. However DNREC/EPA believes this short-term risk could be properly mitigated through proper health and safety programs and site access restrictions.

Subject: Pumping and Capping

1. A PRP suggested the alternative for pumping and capping the Drum Disposal Area would provide a reduction in the mobility of contaminants present in this area.

DNREC/EPA agrees that capping the Drum Disposal Area would to some extent reduce the mobility of the contaminants in this area; however the potential source would still exist. SARA mandates reduction of mobility, toxicity, and volume if at all possible, by using source treatment alternatives. By removing and incinerating these wastes, we will be reducing the mobility, toxicity and volume of the major source of groundwater contamination on site.

Subject: Extent and Nature of Contamination

1. The PRP group feels the nature and extent of contamination at the site still remains undefined.

   DNREC/EPA has investigated, the air, surface soils, formation soils, groundwater and surface waters on or near the site and has adequately defined the nature and extent of contamination. See Chapter 5 Nature and Extent of Contamination pg. 106-217 Remedial Investigation for Delaware Sand & Gravel.

Subject: In-Situ Technologies

1. The PRP group suggested in-situ technologies should be examined in greater detail for the Drum Disposal Area.

   Several types of in-situ treatments were considered in the initial screening (Delaware Sand & Gravel Feasibility Study. Table 2.7) The waste to be treated at Delaware Sand & Gravel varies in contaminant content consequently many of these technologies were eliminated since they are very contaminant

specific. Bioreclamation of residual contaminated soil was the only in-situ treatment reaching the final screening. However, Bioreclamation of soils was determined to exceed the cleanup standards necessary for protection of public health and the environment.

Subject: Groundwater Treatment

1. The PRP group noted that no type of treatment facility was chosen for the groundwater discharge.

   The actual type of treatment required to meet the applicable NPDES requirements will be documented in the second operable unit Record of Decision for Army Creek Landfill. The facility designated under the Army Creek Landfill Record of Decision will treat all discharges.

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